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(71)Applicant : MITSUBISHI ELECTRIC CORP

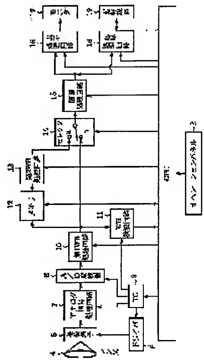
(72)Inventor : TAKEDA TAKESHI
MATOBA NARIHIRO

(54) IMAGE PICKUP DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To solve the problems that photographing intervals are dispersed, that a displaying speed is slow and that it is difficult to perform high speed consecutive photographing and picking up a moving picture because an imaging operation and AWB processing cannot be carried out at the same time.

SOLUTION: This image pickup device is provided with a storing means for storing outputs of a color image pickup element, a white balance detecting means for detecting color information in relation to an object, a first white balance processing means for performing white balance processing based on image data previous by at least one image to a picked-up image, a second white balance processing means for performing white balance processing based on the image data of the picked-up image, a selecting means for selecting the outputs of the first and second white balance processing means, and a controlling means for setting each of the above operation conditions.



CLAIMS

[Claim(s)]
[Claim 1]An imaging device comprising:
A color imaging device which outputs image data which has two or more pixels arranged on a flat surface, and was picturized via an optical system by a pixel unit.
A memory measure which conserves an output of the above-mentioned color imaging device.
A white balance detection means which is arranged at an input side of the above-mentioned memory measure, and detects sexual desire news in connection with a photographic subject.
A 1st white balance processing means to perform white balance processing based on image data before 1 screen at least from an imaging screen, A selecting means which chooses an output of a 2nd white balance processing means to perform white balance processing based on picture data of an imaging screen, and the above-mentioned 1st white balance processing means and the 2nd white balance processing means, and a control means which sets up an operating condition of each above-mentioned means.

[Claim 2]The imaging device according to claim 1 choosing either processing result of the above-mentioned 1st white balance processing means and the 2nd white balance processing means, and performing automatic white balance processing.
[Claim 3]The imaging device according to claim 1 or 2 using the above-mentioned 1st white balance processing means at the time of a high-speed image pick-up which the time of a check of imaging operation and imaging operation follow, and a recording animation.
[Claim 4]The imaging device according to claim 1 or 2 using the above-mentioned 2nd white balance processing means at the time of image pick-up record and still picture record.
[Claim 5]The imaging device according to claim 1 or 2 using the above-mentioned 2nd white balance processing means at the time of stroboscope use.
[Claim 6]An imaging device given [of claim 1 to the claims 4 changing arithmetic precision of

the above-mentioned 1st white balance processing means and the 2nd white balance control means] in any 1 paragraph.
[Claim 7]An imaging device given [of claim 1 to the claims 5, wherein the above-mentioned white balance detection means has a detection region setting means] in any 1 paragraph.
[Claim 8]An imaging device given [of claim 1 to the claims 6, wherein the above-mentioned memory measure memorizes a white-balance-correction coefficient with image data] in any 1 paragraph.
[Claim 9]An imaging device given [of claim 1 to the claims 6, wherein the above-mentioned memory measure has the capacity which records two or more screens and memorizes a white-balance-correction coefficient corresponding to said each screen] in any 1 paragraph.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the imaging device which is adapted for a digital camera, a digital camcorder, a microscope, etc. which change the light from a photographic subject into an electrical signal, and perform image pick-up processing.
[0002]
[Description of the Prior Art]The imaging device which changes light into an electrical signal, carries out signal processing as a digital signal, and is picturized has spread quickly for the reason of compatibility and a user with communication being able to process image data free using solid state image pickup devices, such as CCD. There are many things provided with the automatic control function of an automatic white balance (it abbreviates to AWB hereafter) so that a user can do a high definition image pick-up simply in a digital camera.
[0003]The above AWB integrates the chrominance signal of a photographic subject to change of a light source etc., and automatic correction is carried out so that correlation of each color may be taken and a white balance (it abbreviates to WB hereafter) may be taken. There is a device like drawing 12 shown in JP,11-261949,A as conventional technology.
[0004]Drawing 13 extracts one circuit, in order to explain simple. In drawing 13, 101 an imaging lens and 102 a diaphragm and a shutter, and 103 Image sensors, such as CCD, 104 -- CDS and amplifier, and 105 -- an A/D converter and 106 -- a memory (field memory) and 107 -- as for a YC separate circuit and 111, a clamp circuit and 109 are [a luminosity processing circuit and 113] color temperature detector circuits a color processing circuit and 112 WB circuit and 110 a change over switch and 108.
[0005]By a diaphragm and the shutter 102, light flux condensed with the imaging lens 101 is made into a suitable light exposure, and image formation is carried out on the image sensor 103. Noise is removed by CDS and the amplifier 104 and the image data outputted from the

image sensor 103 is inputted into A/D converter 105. Noise is further removed by the clamp circuit 108 through the a side point of contact of the changeover switch 107 at the same time the image data quantized by A/D converter 105 is written in the memory 106. Although the output of this clamp circuit 108 passes along the WB circuit 109, since the white balance coefficient register of the circuit in a circuit is an initial value at this time, white balance processing is not performed.

[0006]Subsequently, the output of the WB circuit 109 is divided into a luminance signal and a chrominance signal by YC separate circuit 110, and the color-difference signal generated in the middle of the color processing circuit 111 is inputted into the color temperature detector circuit 113 for detecting the color temperature information of a light source when a picture is photoed. WB correction factor is computed by the color temperature detector circuit 113 integrating with a color-difference signal, and CPU (not shown) reading it, and calculating. This coefficient is set as the WB circuit 109.

[0007]Next, image data is read from the memory 106 by connecting the switch 107 to the b side point of contact. This read image data is sent to the WB circuit 109 through the clamp circuit 108, is amended for every colored filter according to WB correction factor set [above-mentioned] up, and is performing the white balance.

[0008]

[Problem(s) to be Solved by the Invention]Since the conventional imaging device was constituted as mentioned above, image data was once stored in the memory 106, WB correction factor was computed from the integrated result by the color temperature detector circuit 113 after that for WB control, and WB processing was performed by reading image data from a memory again. For this reason, since imaging operation and color temperature detection were not able to be performed simultaneously, imaging operation and AWB processing were not able to be performed simultaneously. By this, the photographing interval (field rate) fell, and the display speed became slow, and correspondence was difficult at the time of the image pick-up of high-speed continuous shooting or an animation. The power consumption for memory operation increased and the technical problem that the battery consumption at the time of carrying was remarkable occurred.

[0009]Were made in order that this invention might cancel the above technical problems, and A still picture and high-speed continuous shooting, Also in various imaging modes, such as an animation, the automatic white balance control according to high degree of accuracy, a high speed, and a use is possible, a quality picture can be acquired, and it aims at obtaining the imaging device of low power consumption further.

[0010]

[Means for Solving the Problem]A color imaging device which outputs image data which an imaging device concerning this invention has two or more pixels arranged on a flat surface,

and was picturized via an optical system by a pixel unit, A memory measure which conserves an output of this color imaging device, and a white balance detection means which is arranged at an input side of this memory measure, and detects sexual desire news in connection with a photographic subject, A 1st white balance processing means to perform white balance processing based on image data before 1 screen at least from an imaging screen, Having a selecting means which chooses an output of a 2nd white balance processing means to perform white balance processing based on image data of an imaging screen, and the above-mentioned 1st white balance processing means and the 2nd white balance processing means, a control means sets up an operating condition of each above-mentioned means.

[0011]An imaging device concerning this invention chooses either processing result of the 1st white balance processing means and the 2nd white balance processing means, and performs automatic white balance processing.

[0012]The 1st white balance processing means in an imaging device concerning this invention is used at the time of a high-speed image pick-up which the time of a check of imaging operation and imaging operation follow, and a recording animation.

[0013]The 2nd white balance processing means in an imaging device concerning this invention is used at the time of image pick-up record and still picture record.

[0014]The 2nd white balance processing means in an imaging device concerning this invention is used at the time of stroboscope use.

[0015]An imaging device concerning this invention changes arithmetic precision of the 1st white balance processing means and the 2nd white balance control means.

[0016]A white balance detection means in an imaging device concerning this invention has a detection region setting means.

[0017]A memory measure in an imaging device concerning this invention memorizes a white-balance-correction coefficient with image data.

[0018]A memory measure in an imaging device concerning this invention has the capacity which records two or more screens, and memorizes a white-balance-correction coefficient corresponding to said each screen.

[0019]

[Embodiment of the Invention]Hereafter, one gestalt of implementation of an invention is explained.

Embodiment 1. drawing 1 is a block diagram showing the composition of the imaging device by this embodiment of the invention 1. In drawing 1, control means, such as CPU which 1 equipped with ROM, RAM, etc., and 2 are operation panels which set up operation of imaging devices, such as an electric power switch and a shutter switch. Image sensors, such as CCD to which 4 is outputted with an imaging lens and 5 outputs each chrominance signal of the red (R), the green (G), and blue (B) by a pixel unit, The driver with which 6 drives the image sensor

5, the analog signal processing circuit where 7 performs analog processing of the image sensor 5, It is a timing generator (following, TG) made to generate the signal with which 8 synchronized with the A/D converter and 9 synchronized with control and the image data of the driving timing of the analog signal processing circuit 7 or A/D converter 8.

[0020]The 1st WB processing circuit where 10 performs WB processing to the output signal of A/D converter 8, WB detector circuit which is WB detection means which detects the sexual desire news according [11] to change of the light source of a photographic subject etc., Memories in which 12 can store a part for at least 1 screen, such as FIFO and dual port RAM, The 2nd WB processing circuit where 13 performs WB processing to the signal output of the memory 12, and 14 are the selectors as a selecting means which chooses either of the outputs from the 1st WB processing circuit 10 and the 2nd WB processing circuit 13, and this selector 14 is the auto select according to hand control or photographing mode. The image processing circuit where 15 performs interpolation processing, convert colors, filtering, etc., the display-processing circuit in which 16 carried the drive controlling etc. and video memory of a D/A converter or a display display, A recording processing circuit for the monitor as a display on which 17 used the liquid crystal etc., and 18 to store the picturized picture to the recording medium 19, and 19 are recording media, such as magnetic recording, optical recording, and semiconductor memory.

[0021]Next, operation is explained. The depression of the electric power switch on the operation panel 2 is carried out. The light from a photographic subject passes the taking lens 4, and image formation is carried out on the image sensor 5. This image sensor 5 is driven with the driver 6, and outputs the signal according to a photographic subject. Predetermined timing is given to the driver 6 through TG9 by instructions of CPU1. The analog-image-data signal of the output of the image sensor 5 is quantized by A/D converter 8, after predetermined analog signal processing, such as a gain adjustment, is performed by the analog signal processing circuit 7.

[0022]The digital image data which is an output of A/D converter 8 is inputted into the 1st WB processing circuit 10. In the 1st WB processing circuit 10, the correction factor for every color is computed by CPU1 based on WB detection value from the WB detector circuit 11, and WB processing is performed according to this correction factor (the details of the AWB operation which constitutes this feedback loop are mentioned later).

[0023]The output of the 1st WB processing circuit 10 is simultaneously stored by the memory 12. Also in this process stored, WB detection value is obtained by the WB detector circuit 11 like the aforementioned WB detection operation. The correction factor for every color is computed by CPU1 based on this WB detection value, and WB processing is made by the 2nd WB processing circuit 13 at the time of image data read-out from the memory 12.

[0024]Here, the 1st WB processing and the 2nd WB processing are explained to be processing

of AWB control, detection, and the feedback loop control that comprises calculation using drawing 2, and 3 and 4. Drawing 2 is a block diagram showing the composition of the 1st WB processing circuit 10 and the 2nd WB processing circuit 13. In drawing 2, 21 is a multiplier and carries out the multiplication of the WB correction factor of R color from CPU1 to R color data which is an output of A/D converter 8. 22 and 23 are multipliers and carry out the multiplication of the B correction factor to G color data, and G correction factor and B color data similarly, respectively. The output R' data of the multipliers 21, 22, and 23, such as this, and G'data and B' data are image data after WB processing. WB processing is performed by having and carrying out data processing of the individual correction factor for every color.

[0025]What is necessary is just to use a serial/parallel conversion machine for the input side of each multiplier in the image sensor 5 and A/D converter 8 which are serial as for the data of each color, and are obtained, although the output of A/D converter 8 is an R, G, and B independent output. Although the three multipliers 21-23 are used, it is good also as composition which switches the correction factor of each color to the entry sequenced one by one using one multiplier. In addition, although the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 presupposed that a multiplier is used, this is because the output from A/D converter 8 and light volume (sexual desire news) change of the photographic subject are linearity, and when it has a non-line type relation, it should just use the computing unit according to it.

[0026]Drawing 3 is a block diagram showing the composition of the WB detector circuit 11 which is WB detection. In drawing 3, 24 is an integrator and integrates with R' data which is an output of the multiplier 21 of the 1st WB processing circuit 10. Similarly, 25 and 26 are integrators and integrate with G'data and B' data which is an output of the multipliers 22 and 23 of the 1st WB processing circuit 10, respectively. the outputs of the integrators 24, 25, and 26 for every colors of these are R color, G color, and a detection value used for correction factor calculation of WB processing of each B color.

[0027]Next, operation is explained using the timing chart shown in drawing 4. A frame alignment signal is a signal which shows that the signal output of the image sensor 5 is effective at the time of "H". # In one screen, the detection value for every color of 11#WB detector circuit 1 screen is detected. At this time, WB correction factor of the 1st WB processing circuit 10 sets up the predetermined initial value (preferably, the correction factor of each color is set to 1 so that the output data of A/D converter 8 may be detected as it is).

[0028]# The detection value of 1 is transmitted to CPU1 and compute WB correction factor based on this detection value in CPU1. When the computing method calculates the average value of each color from a detection value and it is based on G, R correction factor Kr and the B correction factor Kb are Kr=. An average (R detection value)/average (G detection value)

Kb = an average (B detection value)/average (G detection value)

Several kilogram of the (G amendment staffs become 1) at this time. Thus, computed WB correction factor is set as the CPU1 to 1st WB processing circuit 10, and the 2nd WB processing circuit 13.

[0029]Therefore, the 1st WB processing circuit 10 performs WB processing using #1 correction factor which was able to obtain the #2 next screen from the image data of #1 screen. WB processing after the following screen uses for WB processing of n screen similarly WB correction factor obtained from the image data of n-1 screen.

[0030]On the other hand, operation of the 2nd WB processing circuit 13 is correlated with operation of the memory 12, and is as follows. # Since a memory write signal is made into "H" so that writing operation may be made for image data to the memory 12 when a frame alignment signal is "H" on one screen, the image data of #1 screen is written in the memory 12.

[0031]# After one screen is completed, the detection value of each color is obtained by the WB detector circuit 11. Calculation operation of the WB coefficient of #1 screen is the same as that of the above than this detection value. # one correction factor is computed -- this amendment -- if it is after calculation was set as the 2nd WB processing circuit 13, image data will be read from the memory 12 to arbitrary timing (memory read is carried out and a signal is "H"). The read image data is data of #1 screen, and WB correction factor is also based on #1 screen. Therefore, the 2nd WB processing circuit 13 performs WB processing using the correction factor obtained from the image data of this #1 screen. While WB processing after the following screen performs writing / read-out control of the memory 10 similarly, the correction factor of n screen is used for WB processing of n screen.

[0032]It returns to drawing 1 and next operation is explained. If the a side point of contact is chosen by the selector 14 according to setting out on the operation panel 2 by a user and the data based on the 2nd WB processing circuit 13 will choose the b side point of contact again, the data based on the 1st WB processing circuit 10 will be chosen, and it will be sent out to the latter image processing circuit 15. In the image processing circuit 15, predetermined image processing, such as interpolation processing, convert colors, filtering, is made. Then, in order to make it display on the monitor 17 by the display-processing circuit 16, processing of predetermined [, such as a chrominance-signal conversion process, a timing conversion process, and definition conversion processing,] is performed, and a photography screen is displayed on the monitor 17. Or if recording operation instructions are published by setting out of the operation panel 2, predetermined data conversion will be performed in the recording processing circuit 18, and it will be recorded on the recording medium 19. A photograph is taken by a series of above operations.

[0033]The example of an effect of the AWB processing by the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 is distinguished as follows. First, the method using the

1st WB processing circuit 10 is processing by the image data in front of 1 screen at least. When NTSC conformity is mentioned as an example, a frame rate is a high speed as visually as 30 Hz, and since there is actually no change of the steep and continuous screen for AC1 / about 30 seconds of a photographic subject (photographing scene) almost, it is satisfactory practically. When the rate of the image sensor 5 of operation is earlier than the write-in rate of the memory 12, it is effective at the time of a high-speed seriography. Next, since processing by the image data of a photography screen is possible if the 2nd WB processing circuit 13 is used, the highly precise AWB control effect can be acquired.
[0034]As mentioned above, according to this Embodiment 1, it writes with the composition of the AWB control which has two WB processing circuits, and is effective in the ability of a user to choose the optimal AWB processing method according to that intention.
[0035]The image sensor 5 may use not only CCD but a CMOS sensor etc. WB processing is performed by performing WB processing, once using that from which the output signal of complementary color systems, such as yellow, magenta, and cyanogen, is acquired and carrying out data conversion to RGB in this case, or subtracting and adding WB correction factor from a color-difference signal. In addition, although it used computing WB correction factor to the read-out data of the memory 12 by CPU, correction factor calculation may consist of circuits which fill the function. Although the example of calculation of the correction factor on the basis of G color was given to WB processing, may any color be sufficient as a reference color?
[0036]Although this invention is an imaging device about an AWB mechanism, it can be adapted also about the imaging device which carries an automatic exposure function and an automatic focusing function. The convergency of AWB operation may change WB correction factor gradually (having a predetermined damping time constant) intentionally based on the detection value of each color.
[0037]Operation of the image sensor 5 to be used is explained at the beginning of embodiment 2. using drawing 5. Many image sensors 5 output the data of resolution set by the pixel number of the monitor 17 called a "draft mode", "monitor mode", etc. to the check of a photography screen (check mode is called hereafter). The example output of the image sensor 5 at this time is shown in drawing 5. 1 to n expresses the number of a scan line. At the photographing mode of A), to outputting all the scan lines from 1 to n, the number of 1, 3, 5..n-2, and the numbers of scan lines outputted like n is reduced, and the frame rate is raised in the check mode of B. Thus, all the pixels are not read but the output according to the display rate of the monitor 17 is performed with thinning out and outputting an output scan line. It performs the following operations, in using operation of such an image sensor 5.
[0038]It explains using the timing chart shown in drawing 6. The mode of a power up presupposes that it is in check mode. CPU1 gives a predetermined command and operation

timing instructions to TG9 so that check mode may be operated. It points to TG9 to the driver 6, and it drives the image sensor 5 so that only the scan line set up beforehand may be outputted. From the image sensor 5, the thinned-out image data is outputted synchronizing with a frame alignment signal.

[0039]In NTSC conformity, the frame rate of #1 to #3 screen in this check mode is 30 Hz. Then, the operation in which a detection value is obtained from the analog signal processing circuit 7 by the WB detector circuit 11 through the 1st WB processing circuit 10 where the initial coefficient was set up is the same as that of Embodiment 1, # The detection value of #n screen is obtained at the time of the end of n screen, and the 1st WB processing circuit 10 performs AWB processing for WB processing of a photography screen (#n) using a correction factor (n-#1 screen) based on the detection value.

[0040]At this time, the b side point of contact is chosen as the selector 14 from CPU1, and the output of the 1st WB processing circuit 10 is sent out to the latter image processing circuit 15. After processing of predetermined [, such as interpolation processing and color conversion filter processing,] becomes in the image processing circuit 15, the screen in check mode is displayed on the monitor 17 through the display-processing circuit 16. A user checks a favorite photography screen, looking at the screen of this monitor 17.

[0041]# While CPU1 will perform predetermined setting out as the image sensor 5 performs read-out which is all the pixels to TG9 if a user does the depression of the shutter on the operation panel 2 when three screens are completed (arbitrary timing in check mode), A write signal is outputted so that "1" may be set as WB correction factor of each color in the 1st WB processing circuit 10 and image data may be written in the memory 12. In the photography at this time, in many cases, read-out of all the pixels takes time, and a frame rate becomes late rather than check mode.

[0042]WB detection value of a photography screen is detected by WB detector circuit, and it is sent out to CPU1 at the same time it outputs a memory write signal synchronizing with a frame alignment signal and the image data which does not carry out WB processing is written in the memory 12. In CPU1, WB correction factor is computed and the correction factor is set as the 2nd WB processing circuit 13.

[0043]Then, the selector 14 is set as the a side point of contact, and memory read is carried out, a signal is outputted, and image data is read from the memory 12. WB processing is carried out by the 2nd WB processing circuit 13, and the read image data is sent out to the image processing circuit 15. Then, definition conversion processing etc. which were doubled with the resolution of the monitor 17 in the display-processing circuit 16 are performed, and it projects on the monitor 17. On the other hand, predetermined data conversion is performed in the recording processing circuit 18, and image data is saved at the recording medium 19. Then, it shifts to check mode again, the same operation as the above is repeated, and imaging

operation is performed.

[0044]Thus, the AWB control by the 1st WB processing means 10 and the photographing mode can write check mode with the AWB control by the 2nd WB processing means 13, and the imaging device in which the AWB control according to the photographing mode is possible can be obtained. For example, the 1st WB processing means 10 is used at the time of an animation image pick-up at the time of the check of imaging operation, and high-speed continuous shooting. The 2nd WB processing means 13 is used at the time of image pick-up record and still picture record.

[0045]If operation of the memory 12 or the 2nd WB processing circuit 13 can be stopped at the time of check mode and image data is stored by the memory 12 in the time of imaging mode, Since operation of the camera head 3, the 1st WB processing circuit 10, and the WB detector circuit 11 becomes unnecessary and supply of an operation clock or a power supply can be stopped, it is effective in the imaging device of low power consumption being obtained. A PAL system can be dealt also with a from the first more high-speed display rate although it was a display type of NTSC conformity in the embodiment.

[0046]There are the following effects at the time of the photography using a stroboscope (not shown). At the time of speed light photography, the a side point of contact is chosen by the selector 14 by CPU1, and it is made to perform AWB control by the memory 12 and the 2nd AWB processing circuit 13. Since AWB control can always be performed by doing in this way using WB correction factor in a self-screen on the screen of the between at the time of a seriography which carried out the strobe light, for example, it is effective in the ability to obtain the imaging device which can obtain a high definition imaging screen.

[0047]That is, after carrying out a dummy strobe light in the former at the time of speed light photography and computing a WB coefficient by setting up at the time of speed light photography choose the 2nd WB processing circuit, this luminescence for photography is performed, but this invention does not need to carry out a dummy strobe light.

[0048]As mentioned above, although [according to the Embodiment 2] memory read-out is immediately performed in a memory after image data writing in photographing mode, After what is necessary will be just to have carried out to arbitrary timing, and it would shift to check mode immediately after memory write operation, for example, the predetermined phenomenon of a photographic subject will not happen, this reading operation may perform memory read-out, and may record it on the recording medium 19.

[0049]Although the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 were considered as the same composition in the above-mentioned Embodiment 1 and Embodiment 2, such arithmetic precision may be changed. For example, suppose that the quantization precision of A/D converter 8 is 8 bits. At this time, WB correction factor computed from CPU1 is 8 bits. The composition of the multiplier of the 1st WB processing 10 shall be 8 bits x 4 bits,

and 4 bits of the latter are WB correction factor. The multiplier composition of the 2nd WB processing circuit 13 shall be 8 bits x 8 bits, and 8 bits of the latter are WB correction factor. The difference in the number of bits of this correction factor differs in the position of a decimal point. The lineblock diagram of the above-mentioned WB correction factor is shown in drawing 7. The correction factor of the 1st WB processing circuit 10 has a binary point position (.) between 2 bits and a triplet from LSB, and, on the other hand, the binary point position of the 2nd WB processing circuit 13 is between 5 bits and 6 bits from LSB.

[0050]Therefore, WB correction range in each WB processing circuit is as follows when the binary system -> decimal system is calculated.

The 1st WB processing circuit -- The 0 - 3.752nd WB processing circuit -- In 0-3.96875CPU1, from the detection results of the WB detector circuit 11. WB correction factor of at least 8 bits is computed, 4 bits of low ranks are omitted from the correction factor of 8 bits in the 1st WB processing circuit 10, and it is set as the 1st WB processing circuit 10 as a correction factor of 4 bits. The correction factor of 8 bits is set to the 2nd WB processing circuit, and WB processing is performed. Here, the difference among both can perform highly precise WB processing, if the 2nd WB processing circuit 13 is used. On the other hand, the 1st WB processing circuit 10 has the simple composition of a computing unit, and can perform more nearly high-speed WB processing.

[0051]Thus, since the arithmetic precision of WB processing means was changed, while becoming possible to be able to choose WB accuracy according to a use and being able to make circuit structure small, it is effective in the imaging device of low cost being obtained.

[0052]It may be arbitrary, sufficient accuracy for WB processing may be obtained, and a ****bit may be sufficient as positions, such as the above-mentioned number of bits and a decimal point. The direction of the 1st WB processing circuit 10 may have high arithmetic precision. It cannot be overemphasized that it can be adapted for the operation etc. of only the integer circuit which does not use a decimal circuit.

[0053]Embodiment 3. and WB detector circuit may be made composition like drawing 8. 30 is WB detector circuit, and the detection region appointed circuit which specifies the detection region where 31 comprises a counter, a comparator, etc., and 32 integrate with R' data which is R integrator which has enable input of operation, and is an output of the multiplier 21 of the 1st WB processing circuit 10, and obtain WB detection value of R color. 33 and 34 are G integrator and B integrator similarly, it integrates with G'data and B' data which is an output of the multipliers 22 and 23, respectively, and WB detection value of G color and B color is obtained.

[0054]Operation is explained. In photographing mode, the line synchronizing signal LG in sync with an output scan line is outputted from TG9. At this time, it is beforehand set as the detection region appointed circuit 31 by making thinning information in check mode into a

compound value from CPU1. LG signal is counted at a counter and this counted value is compared with said compound value. A compound value serves as the enable signal EN of operation, and is outputted to the integrators 32, 33, and 34. Therefore, only the output scan line in the check mode of the image sensor 5 will be detected. The detection value obtained with each integrator is transmitted to CPU1 through a data bus line.

[0055]In check mode, the thinned-out scan line is outputted from the image sensor 5 by carrying out predetermined setting out to TG9. The detection region appointed circuit 31 always outputs this LG signal as an EN signal. Therefore, the integrators 32, 33, and 34 operate synchronizing with LG signal from TG9, and the detection value for every color is obtained.

[0056]The situation at this time is shown in drawing 9. In drawing 9, it is a figure showing the output of the image sensor [can set A to photographing mode and / B] 5 at the time of check mode, and the relation of the scan line for detection. The line for detection which carries out an arrow is controlling the detection region appointed circuit 31 by A) in agreement with the output scan line of B to the scan line being outputted sequentially from 1. Therefore, it is possible to perform AWB control in photographing mode and check mode using the same scan line output.

[0057]As mentioned above, even if the detection region appointed circuit 31 was formed and imaging modes differed according to the Embodiment 3, in order to detect the same output picture elements and to perform AWB control, the AWB control between imaging modes can be coincided and it is effective in a comfortable imaging screen being obtained.

[0058]In Embodiment 3, how to thin out a scan line may not be the above-mentioned limitation, and the output method of the block unit of it being arbitrary and outputting from the scan of the 1st line to the 10th line may be sufficient as an infanticide interval. Although it corresponded to infanticide of the scan line (perpendicular direction), it can be adapted also for the method outputted as the pixel (horizontal direction) in the line shown in drawing 10 (A) is thinned out and it is shown in drawing 10 (B).

[0059]Below embodiment 4. describes this embodiment of the invention 4 according to drawing 1 and drawing 11. Drawing 11 is a figure showing the inside of the memory 12 in this Embodiment 4. The memory 12 is a field which stores the effective pixel of the image data which address space 0-N photoed. WB correction factor of G color of N+2 addresses and 42 are WB correction factors of B color of N+3 addresses WB correction factor of R color stored by N+1 address 40, and 41.

[0060]The operation which computes WB correction factor of each color by CPU1 from the WB detector circuit 11 is the same as that of an old embodiment. If image data is stored to the Nth address of the memory 12, WB correction factor computed by CPU1 will write the WB correction factor 40 of the R color in N+1 address of the memory 12 by CPU1 at the same time

it is set as the 2nd WB processing circuit 13. In N+2 addresses, the WB correction factor 42 of B color is similarly written in the WB correction factor 41 of G color, and N+3 addresses.

[0061]By doing in this way, WB correction factor corresponding to image data exists in the memory 12. Next, the data stored by the memory 12 to arbitrary timing is read one by one, and predetermined image processing by the image processing circuit 15 is performed through WB processing by the 2nd WB processing circuit 13, and the selector 14. If the data of the Nth address of the memory 12 is read, CPU1 will issue the instructions which stop operation to the 2nd AWB processing circuit 13 and the image-processing processing 15. Correctly, bypass operation instructions of data are published so that the input data and output data of each processing circuit may become equal.

[0062]Then, the WB correction factors 40-42 of each color stored by CPU1 from N+1 address to N+3 addresses are read. Although read WB correction factor is similarly inputted into the 2nd WB processing circuit 13 and the image processing circuit 15, since these are set as bypass operation, they are inputted into the display-processing circuit 16 and the recording processing circuit 18 with no processing. In the display-processing circuit 16, although display processing of image data is performed, since the aforementioned WB correction factor is outside the range of an effective pixel, it is not displayed on the monitor 17. In the recording processing circuit 18, said WB correction factor is written in the recording medium 19 with image data. Therefore, the image data and its WB correction factor of a photographic subject are simultaneously recordable.

[0063]According to the Embodiment 4, having enabled it to save WB correction factor according to a photographic subject on the memory 12 As mentioned above, a sake, When a user processes a picture free using a personal computer etc., an imaging device with the sufficient user-friendliness which can refer to the WB coefficient used as the rule of thumb can be obtained.

[0064]In Embodiment 4, when recording WB correction factor on the recording medium 19, presupposed that it passes through the WB processing circuit 13 and the image processing circuit 15, but. The exclusive data line from the memory 12 to the recording processing circuit 18 is formed, and when writing in WB correction factor, after switching to this exclusive data line, WB correction factor may be recorded. The positions which store WB correction factor are not the arbitrary above-mentioned limitations.

[0065]When embodiment 5. and the memory 12 have the capacity of two or more screens, it can use still more effectively. The lineblock diagram showing the memory at this time is shown in drawing 12. the same number in a figure is the same as that of drawing 11 -- an equivalent -- it is . The image data of two screens (#2) is stored from N+4 addresses. The storage range of this #2 image data is to a N+m address. In the WB correction factor 43 of R color of #2 screen, and N+m+2 address, the WB correction factor 45 of B color is stored by the WB correction

factor 44 of G color, and N+m+3 address at N+m+1 address.
[0066]Next, operation is explained. Since it is simple, the imaging operation for two screen is explained. First, the operation in which #1 screen is stored to N address and WB processing coefficient of #1 screen is stored by even N+1 to N+3 addresses is the same as that of the above. # After WB processing coefficient of one screen is stored memory 12, store #2 screen in the memory 12. The image data at this time is stored one by one from N+4 addresses. If image data is stored by even the N+m address, one will compute WB correction factor of#CPU2 screen, and will write the WB correction factor 43 of R color in N+m+1 address. Similarly, in N+m+2 address, the WB correction factor 45 of B color is written in the WB correction factor 44 of G color, and N+m+3 address.
[0067]Then, CPU1 sets the WB correction factor 40 of R color of #1 screen as the 2nd WB processing circuit 13 with reference to N address. Similarly, each of N+1 and N+2 addresses, the WB correction factor 41 of G color, and the WB correction factor 42 of B color are read, and it is set as the 2nd WB processing circuit 13. Next, #1 screen is read from the 0 address of the memory 12 one by one, it transmits to the 2nd WB processing circuit 13 and the image processing circuit 15, each processing is performed, and it records on the monitor 17 at a display or the recording medium 19. WB correction factor is also recorded on the recording medium 19. After the above-mentioned operation finish, with reference to N+m+3 from N+m+1 address, CPU1 sets the WB correction factors 43-45 of #2 screen as the 2nd WB processing circuit 13, repeats processing like the above, and performs imaging operation.
[0068]Having enabled it to store image data and WB correction factor corresponding to it in the memory 12 which can store two or more screens according to the Embodiment 5 As mentioned above, a sake, Also when photography continues (continuous shooting), it becomes unnecessary to provide independently the register holding the relation between image data and WB processing coefficient, a flash memory, etc., and it is effective in the ability to obtain the imaging device of low circuit structure. It becomes unnecessary for a user to grasp the relation between shot data and WB correction factor, and he can get a more user-friendly imaging device.
[0069]
[Effect of the Invention]As mentioned above, the memory measure which conserves the output of a color imaging device according to this invention, The white balance detection means which detects the sexual desire news in connection with a photographic subject, and a 1st white balance processing means to perform white balance processing based on the image data before 1 screen at least from an imaging screen, Since it had composition provided with a 2nd white balance processing means to perform white balance processing based on the image data of an imaging screen, In photographing modes, such as a still picture, high-speed continuous shooting, an animation, effects -- the automatic white balance control according to

high degree of accuracy, a high speed, and a use is possible, and a quality picture is acquired -- are acquired.

[0070]Since according to this invention it constituted so that either processing result of the 1st white balance processing means and the 2nd white balance processing means might be chosen and automatic white balance processing might be performed, The effect that a user can choose the optimal automatic white balance approach according to the intention is acquired.

[0071]According to this invention, since the 1st white balance processing means was constituted so that it might use at the time of the high-speed image pick-up which the time of the check of imaging operation and imaging operation follow, and a recording animation, it is effective in the white balance processing at the time of a high-speed seriography.

[0072]According to this invention, since the 2nd white balance processing means was constituted so that it might use at the time of image pick-up record and still picture record, processing by the image data of a photography screen is possible, and the highly precise white balance processing effect is acquired.

[0073]According to this invention, since the 2nd white balance processing means was constituted so that it might use at the time of stroboscope use, the effect which can obtain a high definition photography screen is acquired.

[0074]According to this invention, since it constituted so that the arithmetic precision of the 1st white balance processing means and the 2nd white balance control means might be changed, it becomes possible to choose the white balance accuracy according to a use. While being able to make circuit structure small, it is effective in the ability to attain low cost.

[0075]According to this invention, since the white balance detection means was constituted so that it might have a detection region setting means, the white balance control between photographing modes can be coincided, and it is effective in a comfortable imaging screen being obtained.

[0076]Since according to this invention the memory measure was constituted so that a white-balance-correction coefficient might be memorized with image data, When a user processes a picture free using a personal computer etc., he is effective in the ability to obtain an imaging device with the sufficient user-friendliness which can refer to the white balance coefficient used as the rule of thumb.

[0077]Since according to this invention the memory measure was constituted so that it might have the capacity which records two or more screens and the white-balance-correction coefficient corresponding to said each screen might be memorized, Also when photography continues (continuous shooting), it becomes unnecessary to provide independently the register holding the relation between image data and WB processing coefficient, a flash memory, etc., and it is effective in the ability to obtain the imaging device of low circuit structure. It is effective

in it becoming unnecessary for a user to grasp the relation between shot data and WB correction factor, and being able to obtain a more user-friendly imaging device.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the imaging device which is adapted for a digital camera, a digital camcorder, a microscope, etc. which change the light from a photographic subject into an electrical signal, and perform image pick-up processing.

[0002]

[Description of the Prior Art]The imaging device which changes light into an electrical signal, carries out signal processing as a digital signal, and is picturized has spread quickly for the reason of compatibility and a user with communication being able to process image data free using solid state image pickup devices, such as CCD. There are many things provided with the automatic control function of an automatic white balance (it abbreviates to AWB hereafter) so that a user can do a high definition image pick-up simply in a digital camera.

[0003]The above AWB integrates the chrominance signal of a photographic subject to change of a light source etc., and automatic correction is carried out so that correlation of each color may be taken and a white balance (it abbreviates to WB hereafter) may be taken. There is a device like drawing 12 shown in JP,11-261949,A as conventional technology.

[0004]Drawing 13 extracts one circuit, in order to explain simple. In drawing 13, 101 an imaging lens and 102 a diaphragm and a shutter, and 103 Image sensors, such as CCD, 104 -- CDS and amplifier, and 105 -- an A/D converter and 106 -- a memory (field memory) and 107 -- as for a YC separate circuit and 111, a clamp circuit and 109 are [a luminosity processing circuit and 113] color temperature detector circuits a color processing circuit and 112 WB circuit and 110 a change over switch and 108.

[0005]By a diaphragm and the shutter 102, light flux condensed with the imaging lens 101 is made into a suitable light exposure, and image formation is carried out on the image sensor 103. Noise is removed by CDS and the amplifier 104 and the image data outputted from the

image sensor 103 is inputted into A/D converter 105. Noise is further removed by the clamp circuit 108 through the a side point of contact of the changeover switch 107 at the same time the image data quantized by A/D converter 105 is written in the memory 106. Although the output of this clamp circuit 108 passes along the WB circuit 109, since the white balance coefficient register of the circuit in a circuit is an initial value at this time, white balance processing is not performed.

[0006]Subsequently, the output of the WB circuit 109 is divided into a luminance signal and a chrominance signal by YC separate circuit 110, and the color-difference signal generated in the middle of the color processing circuit 111 is inputted into the color temperature detector circuit 113 for detecting the color temperature information of a light source when a picture is photoed. WB correction factor is computed by the color temperature detector circuit 113 integrating with a color-difference signal, and CPU (not shown) reading it, and calculating. This coefficient is set as the WB circuit 109.

[0007]Next, image data is read from the memory 106 by connecting the switch 107 to the b side point of contact. This read image data is sent to the WB circuit 109 through the clamp circuit 108, is amended for every colored filter according to WB correction factor set [above-mentioned] up, and is performing the white balance.

[0008]

[Problem(s) to be Solved by the Invention]Since the conventional imaging device was constituted as mentioned above, image data was once stored in the memory 106, WB correction factor was computed from the integrated result by the color temperature detector circuit 113 after that for WB control, and WB processing was performed by reading image data from a memory again. For this reason, since imaging operation and color temperature detection were not able to be performed simultaneously, imaging operation and AWB processing were not able to be performed simultaneously. By this, the photographing interval (field rate) fell, and the display speed became slow, and correspondence was difficult at the time of the image pick-up of high-speed continuous shooting or an animation. The power consumption for memory operation increased and the technical problem that the battery consumption at the time of carrying was remarkable occurred.

[0009]Were made in order that this invention might cancel the above technical problems, and A still picture and high-speed continuous shooting, Also in various imaging modes, such as an animation, the automatic white balance control according to high degree of accuracy, a high speed, and a use is possible, a quality picture can be acquired, and it aims at obtaining the imaging device of low power consumption further.

[0010]

[Means for Solving the Problem]A color imaging device which outputs image data which an imaging device concerning this invention has two or more pixels arranged on a flat surface,

and was picturized via an optical system by a pixel unit, A memory measure which conserves an output of this color imaging device, and a white balance detection means which is arranged at an input side of this memory measure, and detects sexual desire news in connection with a photographic subject, A 1st white balance processing means to perform white balance processing based on image data before 1 screen at least from an imaging screen, Having a selecting means which chooses an output of a 2nd white balance processing means to perform white balance processing based on image data of an imaging screen, and the above-mentioned 1st white balance processing means and the 2nd white balance processing means, a control means sets up an operating condition of each above-mentioned means.

[0011]An imaging device concerning this invention chooses either processing result of the 1st white balance processing means and the 2nd white balance processing means, and performs automatic white balance processing.

[0012]The 1st white balance processing means in an imaging device concerning this invention is used at the time of a high-speed image pick-up which the time of a check of imaging operation and imaging operation follow, and a recording animation.

[0013]The 2nd white balance processing means in an imaging device concerning this invention is used at the time of image pick-up record and still picture record.

[0014]The 2nd white balance processing means in an imaging device concerning this invention is used at the time of stroboscope use.

[0015]An imaging device concerning this invention changes arithmetic precision of the 1st white balance processing means and the 2nd white balance control means.

[0016]A white balance detection means in an imaging device concerning this invention has a detection region setting means.

[0017]A memory measure in an imaging device concerning this invention memorizes a white-balance-correction coefficient with image data.

[0018]A memory measure in an imaging device concerning this invention has the capacity which records two or more screens, and memorizes a white-balance-correction coefficient corresponding to said each screen.

[0019]

[Embodiment of the Invention]Hereafter, one gestalt of implementation of an invention is explained.

Embodiment 1. drawing 1 is a block diagram showing the composition of the imaging device by this embodiment of the invention 1. In drawing 1, control means, such as CPU which 1 equipped with ROM, RAM, etc., and 2 are operation panels which set up operation of imaging devices, such as an electric power switch and a shutter switch. Image sensors, such as CCD to which 4 is outputted with an imaging lens and 5 outputs each chrominance signal of the red (R), the green (G), and blue (B) by a pixel unit, The driver with which 6 drives the image sensor

5, the analog signal processing circuit where 7 performs analog processing of the image sensor 5, It is a timing generator (following, TG) made to generate the signal with which 8 synchronized with the A/D converter and 9 synchronized with control and the image data of the driving timing of the analog signal processing circuit 7 or A/D converter 8.

[0020]The 1st WB processing circuit where 10 performs WB processing to the output signal of A/D converter 8, WB detector circuit which is WB detection means which detects the sexual desire news according [11] to change of the light source of a photographic subject etc., Memories in which 12 can store a part for at least 1 screen, such as FIFO and dual port RAM, The 2nd WB processing circuit where 13 performs WB processing to the signal output of the memory 12, and 14 are the selectors as a selecting means which chooses either of the outputs from the 1st WB processing circuit 10 and the 2nd WB processing circuit 13, and this selector 14 is the auto select according to hand control or photographing mode. The image processing circuit where 15 performs interpolation processing, convert colors, filtering, etc., the display-processing circuit in which 16 carried the drive controlling etc. and video memory of a D/A converter or a display display, A recording processing circuit for the monitor as a display on which 17 used the liquid crystal etc., and 18 to store the picturized picture to the recording medium 19, and 19 are recording media, such as magnetic recording, optical recording, and semiconductor memory.

[0021]Next, operation is explained. The depression of the electric power switch on the operation panel 2 is carried out. The light from a photographic subject passes the taking lens 4, and image formation is carried out on the image sensor 5. This image sensor 5 is driven with the driver 6, and outputs the signal according to a photographic subject. Predetermined timing is given to the driver 6 through TG9 by instructions of CPU1. The analog-image-data signal of the output of the image sensor 5 is quantized by A/D converter 8, after predetermined analog signal processing, such as a gain adjustment, is performed by the analog signal processing circuit 7.

[0022]The digital image data which is an output of A/D converter 8 is inputted into the 1st WB processing circuit 10. In the 1st WB processing circuit 10, the correction factor for every color is computed by CPU1 based on WB detection value from the WB detector circuit 11, and WB processing is performed according to this correction factor (the details of the AWB operation which constitutes this feedback loop are mentioned later).

[0023]The output of the 1st WB processing circuit 10 is simultaneously stored by the memory 12. Also in this process stored, WB detection value is obtained by the WB detector circuit 11 like the aforementioned WB detection operation. The correction factor for every color is computed by CPU1 based on this WB detection value, and WB processing is made by the 2nd WB processing circuit 13 at the time of image data read-out from the memory 12.

[0024]Here, the 1st WB processing and the 2nd WB processing are explained to be processing

of AWB control, detection, and the feedback loop control that comprises calculation using drawing 2, and 3 and 4. Drawing 2 is a block diagram showing the composition of the 1st WB processing circuit 10 and the 2nd WB processing circuit 13. In drawing 2, 21 is a multiplier and carries out the multiplication of the WB correction factor of R color from CPU1 to R color data which is an output of A/D converter 8. 22 and 23 are multipliers and carry out the multiplication of the B correction factor to G color data, and G correction factor and B color data similarly, respectively. The output R' data of the multipliers 21, 22, and 23, such as this, and G'data and B' data are image data after WB processing. WB processing is performed by having and carrying out data processing of the individual correction factor for every color.

[0025]What is necessary is just to use a serial/parallel conversion machine for the input side of each multiplier in the image sensor 5 and A/D converter 8 which are serial as for the data of each color, and are obtained, although the output of A/D converter 8 is an R, G, and B independent output. Although the three multipliers 21-23 are used, it is good also as composition which switches the correction factor of each color to the entry sequenced one by one using one multiplier. In addition, although the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 presupposed that a multiplier is used, this is because the output from A/D converter 8 and light volume (sexual desire news) change of the photographic subject are linearity, and when it has a non-line type relation, it should just use the computing unit according to it.

[0026]Drawing 3 is a block diagram showing the composition of the WB detector circuit 11 which is WB detection. In drawing 3, 24 is an integrator and integrates with R' data which is an output of the multiplier 21 of the 1st WB processing circuit 10. Similarly, 25 and 26 are integrators and integrate with G'data and B' data which is an output of the multipliers 22 and 23 of the 1st WB processing circuit 10, respectively. the outputs of the integrators 24, 25, and 26 for every colors of these are R color, G color, and a detection value used for correction factor calculation of WB processing of each B color.

[0027]Next, operation is explained using the timing chart shown in drawing 4. A frame alignment signal is a signal which shows that the signal output of the image sensor 5 is effective at the time of "H". # In one screen, the detection value for every color of 11#WB detector circuit 1 screen is detected. At this time, WB correction factor of the 1st WB processing circuit 10 sets up the predetermined initial value (preferably, the correction factor of each color is set to 1 so that the output data of A/D converter 8 may be detected as it is).

[0028]# The detection value of 1 is transmitted to CPU1 and compute WB correction factor based on this detection value in CPU1. When the computing method calculates the average value of each color from a detection value and it is based on G, R correction factor Kr and the B correction factor Kb are Kr=. An average (R detection value)/average (G detection value)
Kb = an average (B detection value)/average (G detection value)

Several kilogram of the (G amendment staffs become 1) at this time. Thus, computed WB correction factor is set as the CPU1 to 1st WB processing circuit 10, and the 2nd WB processing circuit 13.
[0029]Therefore, the 1st WB processing circuit 10 performs WB processing using #1 correction factor which was able to obtain the #2 next screen from the image data of #1 screen. WB processing after the following screen uses for WB processing of n screen similarly WB correction factor obtained from the image data of n-1 screen.
[0030]On the other hand, operation of the 2nd WB processing circuit 13 is correlated with operation of the memory 12, and is as follows. # Since a memory write signal is made into "H" so that writing operation may be made for image data to the memory 12 when a frame alignment signal is "H" on one screen, the image data of #1 screen is written in the memory 12.
[0031]# After one screen is completed, the detection value of each color is obtained by the WB detector circuit 11. Calculation operation of the WB coefficient of #1 screen is the same as that of the above than this detection value. # one correction factor is computed -- this amendment -- if it is after calculation was set as the 2nd WB processing circuit 13, image data will be read from the memory 12 to arbitrary timing (memory read is carried out and a signal is "H"). The read image data is data of #1 screen, and WB correction factor is also based on #1 screen. Therefore, the 2nd WB processing circuit 13 performs WB processing using the correction factor obtained from the image data of this #1 screen. While WB processing after the following screen performs writing / read-out control of the memory 10 similarly, the correction factor of n screen is used for WB processing of n screen.
[0032]It returns to drawing 1 and next operation is explained. If the a side point of contact is chosen by the selector 14 according to setting out on the operation panel 2 by a user and the data based on the 2nd WB processing circuit 13 will choose the b side point of contact again, the data based on the 1st WB processing circuit 10 will be chosen, and it will be sent out to the latter image processing circuit 15. In the image processing circuit 15, predetermined image processing, such as interpolation processing, convert colors, filtering, is made. Then, in order to make it display on the monitor 17 by the display-processing circuit 16, processing of predetermined [, such as a chrominance-signal conversion process, a timing conversion process, and definition conversion processing,] is performed, and a photography screen is displayed on the monitor 17. Or if recording operation instructions are published by setting out of the operation panel 2, predetermined data conversion will be performed in the recording processing circuit 18, and it will be recorded on the recording medium 19. A photograph is taken by a series of above operations.
[0033]The example of an effect of the AWB processing by the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 is distinguished as follows. First, the method using the

1st WB processing circuit 10 is processing by the image data in front of 1 screen at least. When NTSC conformity is mentioned as an example, a frame rate is a high speed as visually as 30 Hz, and since there is actually no change of the steep and continuous screen for AC1 / about 30 seconds of a photographic subject (photographing scene) almost, it is satisfactory practically. When the rate of the image sensor 5 of operation is earlier than the write-in rate of the memory 12, it is effective at the time of a high-speed seriography. Next, since processing by the image data of a photography screen is possible if the 2nd WB processing circuit 13 is used, the highly precise AWB control effect can be acquired.

[0034]As mentioned above, according to this Embodiment 1, it writes with the composition of the AWB control which has two WB processing circuits, and is effective in the ability of a user to choose the optimal AWB processing method according to that intention.

[0035]The image sensor 5 may use not only CCD but a CMOS sensor etc. WB processing is performed by performing WB processing, once using that from which the output signal of complementary color systems, such as yellow, magenta, and cyanogen, is acquired and carrying out data conversion to RGB in this case, or subtracting and adding WB correction factor from a color-difference signal. In addition, although it used computing WB correction factor to the read-out data of the memory 12 by CPU, correction factor calculation may consist of circuits which fill the function. Although the example of calculation of the correction factor on the basis of G color was given to WB processing, may any color be sufficient as a reference color?

[0036]Although this invention is an imaging device about an AWB mechanism, it can be adapted also about the imaging device which carries an automatic exposure function and an automatic focusing function. The convergency of AWB operation may change WB correction factor gradually (having a predetermined damping time constant) intentionally based on the detection value of each color.

[0037]Operation of the image sensor 5 to be used is explained at the beginning of embodiment 2. using drawing 5. Many image sensors 5 output the data of resolution set by the pixel number of the monitor 17 called a "draft mode", "monitor mode", etc. to the check of a photography screen (check mode is called hereafter). The example output of the image sensor 5 at this time is shown in drawing 5. 1 to n expresses the number of a scan line. At the photographing mode of A), to outputting all the scan lines from 1 to n, the number of 1, 3, 5..n-2, and the numbers of scan lines outputted like n is reduced, and the frame rate is raised in the check mode of B. Thus, all the pixels are not read but the output according to the display rate of the monitor 17 is performed with thinning out and outputting an output scan line. It performs the following operations, in using operation of such an image sensor 5.

[0038]It explains using the timing chart shown in drawing 6. The mode of a power up presupposes that it is in check mode. CPU1 gives a predetermined command and operation

timing instructions to TG9 so that check mode may be operated. It points to TG9 to the driver 6, and it drives the image sensor 5 so that only the scan line set up beforehand may be outputted. From the image sensor 5, the thinned-out image data is outputted synchronizing with a frame alignment signal.

[0039]In NTSC conformity, the frame rate of #1 to #3 screen in this check mode is 30 Hz. Then, the operation in which a detection value is obtained from the analog signal processing circuit 7 by the WB detector circuit 11 through the 1st WB processing circuit 10 where the initial coefficient was set up is the same as that of Embodiment 1, # The detection value of #n screen is obtained at the time of the end of n screen, and the 1st WB processing circuit 10 performs AWB processing for WB processing of a photography screen (#n) using a correction factor (n-#1 screen) based on the detection value.

[0040]At this time, the b side point of contact is chosen as the selector 14 from CPU1, and the output of the 1st WB processing circuit 10 is sent out to the latter image processing circuit 15. After processing of predetermined [, such as interpolation processing and color conversion filter processing,] becomes in the image processing circuit 15, the screen in check mode is displayed on the monitor 17 through the display-processing circuit 16. A user checks a favorite photography screen, looking at the screen of this monitor 17.

[0041]# While CPU1 will perform predetermined setting out as the image sensor 5 performs read-out which is all the pixels to TG9 if a user does the depression of the shutter on the operation panel 2 when three screens are completed (arbitrary timing in check mode), A write signal is outputted so that "1" may be set as WB correction factor of each color in the 1st WB processing circuit 10 and image data may be written in the memory 12. In the photography at this time, in many cases, read-out of all the pixels takes time, and a frame rate becomes late rather than check mode.

[0042]WB detection value of a photography screen is detected by WB detector circuit, and it is sent out to CPU1 at the same time it outputs a memory write signal synchronizing with a frame alignment signal and the image data which does not carry out WB processing is written in the memory 12. In CPU1, WB correction factor is computed and the correction factor is set as the 2nd WB processing circuit 13.

[0043]Then, the selector 14 is set as the a side point of contact, and memory read is carried out, a signal is outputted, and image data is read from the memory 12. WB processing is carried out by the 2nd WB processing circuit 13, and the read image data is sent out to the image processing circuit 15. Then, definition conversion processing etc. which were doubled with the resolution of the monitor 17 in the display-processing circuit 16 are performed, and it projects on the monitor 17. On the other hand, predetermined data conversion is performed in the recording processing circuit 18, and image data is saved at the recording medium 19. Then, it shifts to check mode again, the same operation as the above is repeated, and imaging

operation is performed.
[0044]Thus, the AWB control by the 1st WB processing means 10 and the photographing mode can write check mode with the AWB control by the 2nd WB processing means 13, and the imaging device in which the AWB control according to the photographing mode is possible can be obtained. For example, the 1st WB processing means 10 is used at the time of an animation image pick-up at the time of the check of imaging operation, and high-speed continuous shooting. The 2nd WB processing means 13 is used at the time of image pick-up record and still picture record.
[0045]If operation of the memory 12 or the 2nd WB processing circuit 13 can be stopped at the time of check mode and image data is stored by the memory 12 in the time of imaging mode, Since operation of the camera head 3, the 1st WB processing circuit 10, and the WB detector circuit 11 becomes unnecessary and supply of an operation clock or a power supply can be stopped, it is effective in the imaging device of low power consumption being obtained. A PAL system can be dealt also with a from the first more high-speed display rate although it was a display type of NTSC conformity in the embodiment.
[0046]There are the following effects at the time of the photography using a stroboscope (not shown). At the time of speed light photography, the a side point of contact is chosen by the selector 14 by CPU1, and it is made to perform AWB control by the memory 12 and the 2nd AWB processing circuit 13. Since AWB control can always be performed by doing in this way using WB correction factor in a self-screen on the screen of the between at the time of a seriography which carried out the strobe light, for example, it is effective in the ability to obtain the imaging device which can obtain a high definition imaging screen.
[0047]That is, after carrying out a dummy strobe light in the former at the time of speed light photography and computing a WB coefficient by setting up at the time of speed light photography choose the 2nd WB processing circuit, this luminescence for photography is performed, but this invention does not need to carry out a dummy strobe light.
[0048]As mentioned above, although [according to the Embodiment 2] memory read-out is immediately performed in a memory after image data writing in photographing mode, After what is necessary will be just to have carried out to arbitrary timing, and it would shift to check mode immediately after memory write operation, for example, the predetermined phenomenon of a photographic subject will not happen, this reading operation may perform memory read-out, and may record it on the recording medium 19.
[0049]Although the 1st WB processing circuit 10 and the 2nd WB processing circuit 13 were considered as the same composition in the above-mentioned Embodiment 1 and Embodiment 2, such arithmetic precision may be changed. For example, suppose that the quantization precision of A/D converter 8 is 8 bits. At this time, WB correction factor computed from CPU1 is 8 bits. The composition of the multiplier of the 1st WB processing 10 shall be 8 bits x 4 bits,

and 4 bits of the latter are WB correction factor. The multiplier composition of the 2nd WB processing circuit 13 shall be 8 bits x 8 bits, and 8 bits of the latter are WB correction factor. The difference in the number of bits of this correction factor differs in the position of a decimal point. The lineblock diagram of the above-mentioned WB correction factor is shown in drawing 7. The correction factor of the 1st WB processing circuit 10 has a binary point position (.) between 2 bits and a triplet from LSB, and, on the other hand, the binary point position of the 2nd WB processing circuit 13 is between 5 bits and 6 bits from LSB.

[0050]Therefore, WB correction range in each WB processing circuit is as follows when the binary system -> decimal system is calculated.

The 1st WB processing circuit -- The 0 - 3.752nd WB processing circuit -- In 0-3.96875CPU1, from the detection results of the WB detector circuit 11. WB correction factor of at least 8 bits is computed, 4 bits of low ranks are omitted from the correction factor of 8 bits in the 1st WB processing circuit 10, and it is set as the 1st WB processing circuit 10 as a correction factor of 4 bits. The correction factor of 8 bits is set to the 2nd WB processing circuit, and WB processing is performed. Here, the difference among both can perform highly precise WB processing, if the 2nd WB processing circuit 13 is used. On the other hand, the 1st WB processing circuit 10 has the simple composition of a computing unit, and can perform more nearly high-speed WB processing.

[0051]Thus, since the arithmetic precision of WB processing means was changed, while becoming possible to be able to choose WB accuracy according to a use and being able to make circuit structure small, it is effective in the imaging device of low cost being obtained.

[0052]It may be arbitrary, sufficient accuracy for WB processing may be obtained, and a ****bit may be sufficient as positions, such as the above-mentioned number of bits and a decimal point. The direction of the 1st WB processing circuit 10 may have high arithmetic precision. It cannot be overemphasized that it can be adapted for the operation etc. of only the integer circuit which does not use a decimal circuit.

[0053]Embodiment 3. and WB detector circuit may be made composition like drawing 8. 30 is WB detector circuit, and the detection region appointed circuit which specifies the detection region where 31 comprises a counter, a comparator, etc., and 32 integrate with R' data which is R integrator which has enable input of operation, and is an output of the multiplier 21 of the 1st WB processing circuit 10, and obtain WB detection value of R color. 33 and 34 are G integrator and B integrator similarly, it integrates with G'data and B' data which is an output of the multipliers 22 and 23, respectively, and WB detection value of G color and B color is obtained.

[0054]Operation is explained. In photographing mode, the line synchronizing signal LG in sync with an output scan line is outputted from TG9. At this time, it is beforehand set as the detection region appointed circuit 31 by making thinning information in check mode into a

compound value from CPU1. LG signal is counted at a counter and this counted value is compared with said compound value. A compound value serves as the enable signal EN of operation, and is outputted to the integrators 32, 33, and 34. Therefore, only the output scan line in the check mode of the image sensor 5 will be detected. The detection value obtained with each integrator is transmitted to CPU1 through a data bus line.

[0055]In check mode, the thinned-out scan line is outputted from the image sensor 5 by carrying out predetermined setting out to TG9. The detection region appointed circuit 31 always outputs this LG signal as an EN signal. Therefore, the integrators 32, 33, and 34 operate synchronizing with LG signal from TG9, and the detection value for every color is obtained.

[0056]The situation at this time is shown in drawing 9. In drawing 9, it is a figure showing the output of the image sensor [can set A to photographing mode and / B] 5 at the time of check mode, and the relation of the scan line for detection. The line for detection which carries out an arrow is controlling the detection region appointed circuit 31 by A) in agreement with the output scan line of B to the scan line being outputted sequentially from 1. Therefore, it is possible to perform AWB control in photographing mode and check mode using the same scan line output.

[0057]As mentioned above, even if the detection region appointed circuit 31 was formed and imaging modes differed according to the Embodiment 3, in order to detect the same output picture elements and to perform AWB control, the AWB control between imaging modes can be coincided and it is effective in a comfortable imaging screen being obtained.

[0058]In Embodiment 3, how to thin out a scan line may not be the above-mentioned limitation, and the output method of the block unit of it being arbitrary and outputting from the scan of the 1st line to the 10th line may be sufficient as an infanticide interval. Although it corresponded to infanticide of the scan line (perpendicular direction), it can be adapted also for the method outputted as the pixel (horizontal direction) in the line shown in drawing 10 (A) is thinned out and it is shown in drawing 10 (B).

[0059]Below embodiment 4. describes this embodiment of the invention 4 according to drawing 1 and drawing 11. Drawing 11 is a figure showing the inside of the memory 12 in this Embodiment 4. The memory 12 is a field which stores the effective pixel of the image data which address space 0-N photoed. WB correction factor of G color of N+2 addresses and 42 are WB correction factors of B color of N+3 addresses WB correction factor of R color stored by N+1 address 40, and 41.

[0060]The operation which computes WB correction factor of each color by CPU1 from the WB detector circuit 11 is the same as that of an old embodiment. If image data is stored to the Nth address of the memory 12, WB correction factor computed by CPU1 will write the WB correction factor 40 of the R color in N+1 address of the memory 12 by CPU1 at the same time

it is set as the 2nd WB processing circuit 13. In N+2 addresses, the WB correction factor 42 of B color is similarly written in the WB correction factor 41 of G color, and N+3 addresses.
[0061]By doing in this way, WB correction factor corresponding to image data exists in the memory 12. Next, the data stored by the memory 12 to arbitrary timing is read one by one, and predetermined image processing by the image processing circuit 15 is performed through WB processing by the 2nd WB processing circuit 13, and the selector 14. If the data of the Nth address of the memory 12 is read, CPU1 will issue the instructions which stop operation to the 2nd AWB processing circuit 13 and the image-processing processing 15. Correctly, bypass operation instructions of data are published so that the input data and output data of each processing circuit may become equal.
[0062]Then, the WB correction factors 40-42 of each color stored by CPU1 from N+1 address to N+3 addresses are read. Although read WB correction factor is similarly inputted into the 2nd WB processing circuit 13 and the image processing circuit 15, since these are set as bypass operation, they are inputted into the display-processing circuit 16 and the recording processing circuit 18 with no processing. In the display-processing circuit 16, although display processing of image data is performed, since the aforementioned WB correction factor is outside the range of an effective pixel, it is not displayed on the monitor 17. In the recording processing circuit 18, said WB correction factor is written in the recording medium 19 with image data. Therefore, the image data and its WB correction factor of a photographic subject are simultaneously recordable.
[0063]According to the Embodiment 4, having enabled it to save WB correction factor according to a photographic subject on the memory 12 As mentioned above, a sake, When a user processes a picture free using a personal computer etc., an imaging device with the sufficient user-friendliness which can refer to the WB coefficient used as the rule of thumb can be obtained.
[0064]In Embodiment 4, when recording WB correction factor on the recording medium 19, presupposed that it passes through the WB processing circuit 13 and the image processing circuit 15, but. The exclusive data line from the memory 12 to the recording processing circuit 18 is formed, and when writing in WB correction factor, after switching to this exclusive data line, WB correction factor may be recorded. The positions which store WB correction factor are not the arbitrary above-mentioned limitations.
[0065]When embodiment 5. and the memory 12 have the capacity of two or more screens, it can use still more effectively. The lineblock diagram showing the memory at this time is shown in drawing 12. the same number in a figure is the same as that of drawing 11 -- an equivalent -- it is . The image data of two screens (#2) is stored from N+4 addresses. The storage range of this #2 image data is to a N+m address. In the WB correction factor 43 of R color of #2 screen, and N+m+2 address, the WB correction factor 45 of B color is stored by the WB correction

factor 44 of G color, and N+m+3 address at N+m+1 address.

[0066]Next, operation is explained. Since it is simple, the imaging operation for two screen is explained. First, the operation in which #1 screen is stored to N address and WB processing coefficient of #1 screen is stored by even N+1 to N+3 addresses is the same as that of the above. # After WB processing coefficient of one screen is stored memory 12, store #2 screen in the memory 12. The image data at this time is stored one by one from N+4 addresses. If image data is stored by even the N+m address, one will compute WB correction factor of#CPU2 screen, and will write the WB correction factor 43 of R color in N+m+1 address. Similarly, in N+m+2 address, the WB correction factor 45 of B color is written in the WB correction factor 44 of G color, and N+m+3 address.

[0067]Then, CPU1 sets the WB correction factor 40 of R color of #1 screen as the 2nd WB processing circuit 13 with reference to N address. Similarly, each of N+1 and N+2 addresses, the WB correction factor 41 of G color, and the WB correction factor 42 of B color are read, and it is set as the 2nd WB processing circuit 13. Next, #1 screen is read from the 0 address of the memory 12 one by one, it transmits to the 2nd WB processing circuit 13 and the image processing circuit 15, each processing is performed, and it records on the monitor 17 at a display or the recording medium 19. WB correction factor is also recorded on the recording medium 19. After the above-mentioned operation finish, with reference to N+m+3 from N+m+1 address, CPU1 sets the WB correction factors 43-45 of #2 screen as the 2nd WB processing circuit 13, repeats processing like the above, and performs imaging operation.

[0068]Having enabled it to store image data and WB correction factor corresponding to it in the memory 12 which can store two or more screens according to the Embodiment 5 As mentioned above, a sake, Also when photography continues (continuous shooting), it becomes unnecessary to provide independently the register holding the relation between image data and WB processing coefficient, a flash memory, etc., and it is effective in the ability to obtain the imaging device of low circuit structure. It becomes unnecessary for a user to grasp the relation between shot data and WB correction factor, and he can get a more user-friendly imaging device.

[0069]

[Effect of the Invention]As mentioned above, the memory measure which conserves the output of a color imaging device according to this invention, The white balance detection means which detects the sexual desire news in connection with a photographic subject, and a 1st white balance processing means to perform white balance processing based on the image data before 1 screen at least from an imaging screen, Since it had composition provided with a 2nd white balance processing means to perform white balance processing based on the image data of an imaging screen, In photographing modes, such as a still picture, high-speed continuous shooting, an animation, effects -- the automatic white balance control according to

high degree of accuracy, a high speed, and a use is possible, and a quality picture is acquired -- are acquired.

[0070]Since according to this invention it constituted so that either processing result of the 1st white balance processing means and the 2nd white balance processing means might be chosen and automatic white balance processing might be performed, The effect that a user can choose the optimal automatic white balance approach according to the intention is acquired.

[0071]According to this invention, since the 1st white balance processing means was constituted so that it might use at the time of the high-speed image pick-up which the time of the check of imaging operation and imaging operation follow, and a recording animation, it is effective in the white balance processing at the time of a high-speed seriography.

[0072]According to this invention, since the 2nd white balance processing means was constituted so that it might use at the time of image pick-up record and still picture record, processing by the image data of a photography screen is possible, and the highly precise white balance processing effect is acquired.

[0073]According to this invention, since the 2nd white balance processing means was constituted so that it might use at the time of stroboscope use, the effect which can obtain a high definition photography screen is acquired.

[0074]According to this invention, since it constituted so that the arithmetic precision of the 1st white balance processing means and the 2nd white balance control means might be changed, it becomes possible to choose the white balance accuracy according to a use. While being able to make circuit structure small, it is effective in the ability to attain low cost.

[0075]According to this invention, since the white balance detection means was constituted so that it might have a detection region setting means, the white balance control between photographing modes can be coincided, and it is effective in a comfortable imaging screen being obtained.

[0076]Since according to this invention the memory measure was constituted so that a white-balance-correction coefficient might be memorized with image data, When a user processes a picture free using a personal computer etc., he is effective in the ability to obtain an imaging device with the sufficient user-friendliness which can refer to the white balance coefficient used as the rule of thumb.

[0077]Since according to this invention the memory measure was constituted so that it might have the capacity which records two or more screens and the white-balance-correction coefficient corresponding to said each screen might be memorized, Also when photography continues (continuous shooting), it becomes unnecessary to provide independently the register holding the relation between image data and WB processing coefficient, a flash memory, etc., and it is effective in the ability to obtain the imaging device of low circuit structure. It is effective

in it becoming unnecessary for a user to grasp the relation between shot data and WB correction factor, and being able to obtain a more user-friendly imaging device.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a lineblock diagram showing the imaging device by this embodiment of the invention 1.
[Drawing 2]It is a lineblock diagram showing WB processing circuit by this embodiment of the invention 1.
[Drawing 3]It is a lineblock diagram showing WB detector circuit by this embodiment of the invention 1.
[Drawing 4]It is a timing chart figure by this embodiment of the invention 1.
[Drawing 5]It is a figure showing the output of the image sensor by this embodiment of the invention 2.
[Drawing 6]It is a timing chart figure by this embodiment of the invention 2.
[Drawing 7]It is a figure showing WB correction factor by this embodiment of the invention 2.
[Drawing 8]It is a figure showing WB detector circuit by this embodiment of the invention 3.
[Drawing 9]It is a figure showing WB detection region by this embodiment of the invention 3.
[Drawing 10]It is an explanatory view of how to thin out the scan line by this embodiment of the invention 3.
[Drawing 11]It is a figure showing the memory by this embodiment of the invention 4.
[Drawing 12]It is a figure showing the memory by this embodiment of the invention 5.
[Drawing 13]It is a lineblock diagram showing the conventional imaging device.
[Description of Notations]
1 CPU and 2 An operation panel and 3 A lens and 5 Image sensor, 8 An A/D converter, the 101st WB processing circuit, 11 WB detector circuit, and 12 Memory, 13 The 2nd WB processing circuit and 14 A selector and 15 An image processing circuit and 17 Monitor, 18 A recording processing circuit and 19 A recording medium, and 21, 22 and 23 Multiplier, 24, 25, and 26 The detection region appointed circuit, and 32, 33 and 34 An integrator, 30 WB

detector circuit, and 31 An integrator, WB correction factor for 40 R, WB correction factor for 41 G, WB correction factor for 42 B, WB correction factor for 43 R, WB correction factor for 44 G, WB correction factor for 45 B.

[Translation done.]

* NOTICES *

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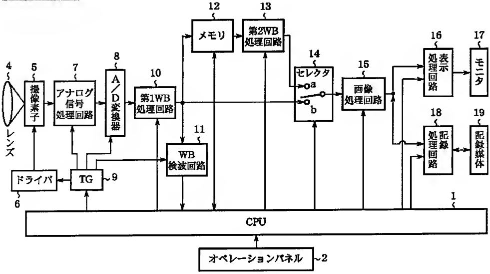
damages caused by the use of this translation.

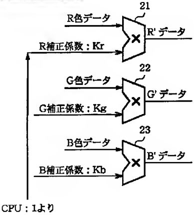
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

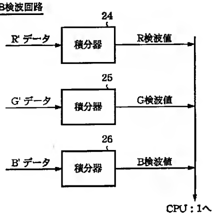


[Drawing 2]

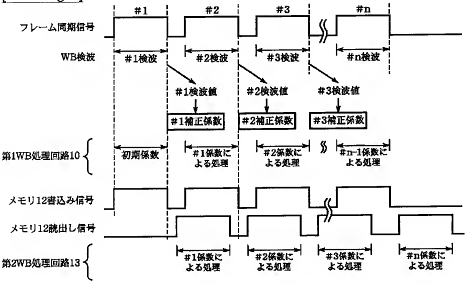


[Drawing 3]

11 : WB検波回路



[Drawing 4]



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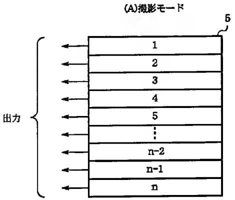
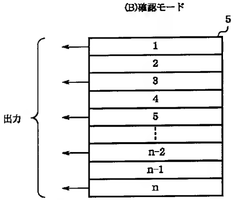
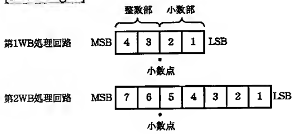
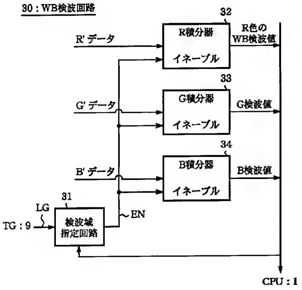




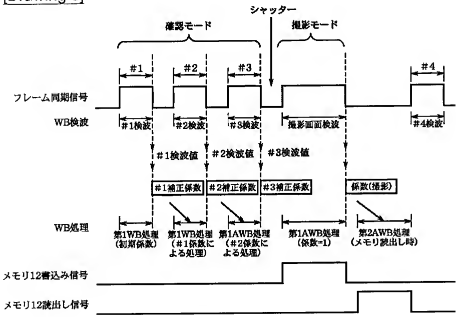
[Drawing 7]



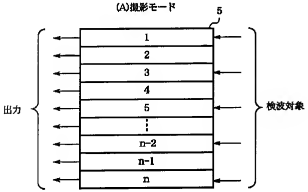
[Drawing 8]

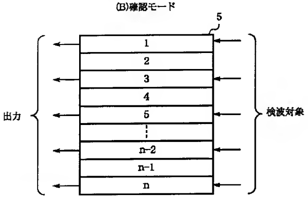


[Drawing 6]

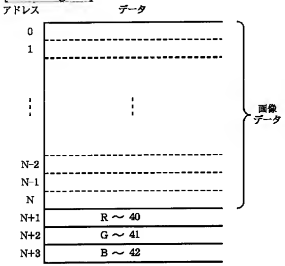


[Drawing 9]

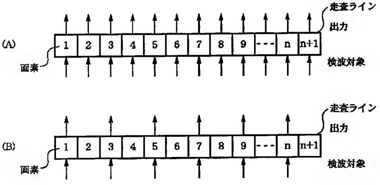




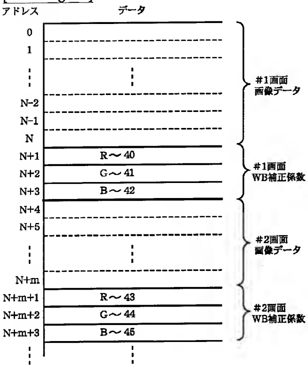
[Drawing 11]



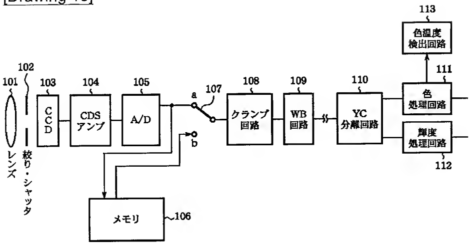
[Drawing 10]



[Drawing 12]



[Drawing 13]



[Translation done.]

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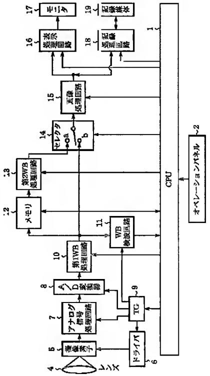
(71)出願人　000006013
三菱電機株式会社
東京都千代田区丸の内二丁目2番3号
(72)発明者　竹田　岳
東京都千代田区丸の内二丁目2番3号　三菱電機株式会社内
(72)発明者　的場　成浩
東京都千代田区丸の内二丁目2番3号　三菱電機株式会社内
(74)代理人　100066474
弁理士　田澤　博昭　（外1名）

最終頁に続く

(54)【発明の名称】　撮像装置

(57)【要約】
【課題】　撮像動作とＡＷＢ処理が同時に行えないため、撮影間隔が低下し、表示速度が遅い、高速連写や動画の撮像時には対応が困難等の課題があった。
【解決手段】　カラー撮像素子の出力を蓄える記憶手段と、被写体に関わる色情報を検波するホワイトバランス検波手段と、撮像画面より少なくとも１画面以前の画像データに基づいてホワイトバランス処理を行う第１ホワイトバランス処理手段と、撮像画面の画面データに基づいてホワイトバランス処理を行う第２ホワイトバランス処理手段と、上記第１、第２ホワイトバランス処理手段の出力を選択する選択手段と、上記各動作条件を設定する制御手段とを備えたものである。



【特許請求の範囲】

【請求項１】　平面上に配列された複数の画素を有し、光学系を介して撮像した画像データを画素単位で出力するカラー撮像素子と、
上記カラー撮像素子の出力を蓄える記憶手段と、
上記記憶手段の入力側に配置され被写体に関わる色情報を検波するホワイトバランス検波手段と、
撮像画面より少なくとも１画面以前の画像データに基づいてホワイトバランス処理を行う第１ホワイトバランス処理手段と、
撮像画面の画面データに基づいてホワイトバランス処理を行う第２ホワイトバランス処理手段と、
上記第１ホワイトバランス処理手段と第２ホワイトバランス処理手段との出力を選択する選択手段と、
上記各手段の動作条件を設定する制御手段と、を備えた撮像装置。

【請求項２】　上記第１ホワイトバランス処理手段と、第２ホワイトバランス処理手段のいずれかの処理結果を選択してオートホワイトバランス処理を行うことを特徴とする請求項１記載の撮像装置。

【請求項３】　上記第１ホワイトバランス処理手段は、撮像動作の確認時と撮像動作が連続する高速撮像時や動画記録時に用いることを特徴とする請求項１または請求項２記載の撮像装置。

【請求項４】　上記第２ホワイトバランス処理手段は、撮像記録時と静止画記録時に用いることを特徴とする請求項１または請求項２記載の撮像装置。

【請求項５】　上記第２ホワイトバランス処理手段は、ストロボ使用時に用いることを特徴とする請求項１または請求項２記載の撮像装置。

【請求項６】　上記第１ホワイトバランス処理手段と、第２ホワイトバランス制御手段の演算精度を異ならせたことを特徴とする請求項１から請求項４のうちのいずれか１項記載の撮像装置。

【請求項７】　上記ホワイトバランス検波手段は、検波域指定手段を有することを特徴とする請求項１から請求項５のうちのいずれか１項記載の撮像装置。

【請求項８】　上記記憶手段は、ホワイトバランス補正係数を画像データとともに記憶することを特徴とする請求項１から請求項６のうちのいずれか１項記載の撮像装置。

【請求項９】　上記記憶手段は、複数の画面を記録する容量を有し、前記各画面に対応するホワイトバランス補正係数を記憶することを特徴とする請求項１から請求項６のうちのいずれか１項記載の撮像装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】この発明は、被写体からの光を電気信号に変換し撮像処理を行うデジタルカメラやデジタルビデオカメラ、顕微鏡等に適応される撮像装置に関するものである。

【０００２】

【従来の技術】ＣＣＤ等の固体撮像素子を用いて、光を電気信号に変換し、デジタル信号として信号処理し撮像する撮像装置は、通信との親和性や使用者が自在に画像データを加工できる等の理由により急速に普及している。デジタルカメラでは使用者が簡単に高画質な撮像ができるように、オートホワイトバランス（以下、ＡＷＢと略す）の自動制御機能を備えているものが多い。

【０００３】上記ＡＷＢは、光源等の変化に対して被写体の色信号を積算して、それぞれの色の相関をとりホワイトバランス（以下、ＷＢと略す）をとるように自動補正するものである。従来技術として特開平１１－２６１９４９号公報に示された図１２のような装置がある。

【０００４】図１３は説明を簡略にするために一回路を抜粋したものである。図１３において、１０１は撮像レンズ、１０２は絞り・シャッタ、１０３はＣＣＤ等の撮像素子、１０４はＣＤＳ・アンプ、１０５はＡ／Ｄコンバータ、１０６はメモリ（フイールドメモリ）、１０７は切り換えスイッチ、１０８はクランプ回路、１０９はＷＢ回路、１１０はＹＣ分離回路、１１１は色処理回路、１１２は輝度処理回路、１１３は色温度検出回路である。

【０００５】撮像レンズ１０１によって集光された光束は、絞り・シャッタ１０２によって適切な露光量とされ、撮像素子１０３上に結像される。撮像素子１０３から出力された画像データはＣＤＳ・アンプ１０４により雑音が除去され、Ａ／Ｄコンバータ１０５に入力される。Ａ／Ｄコンバータ１０５により量子化された画像データは、メモリ１０６に書込まれると同時に、切換えスイッチ１０７のａ側接点を経てクランプ回路１０８によってさらに雑音が除去される。このクランプ回路１０８の出力はＷＢ回路１０９を通るが、この時は回路内回路のホワイトバランス係数レジスタが初期値になっているため、ホワイトバランス処理は行われない。

【０００６】ついで、ＷＢ回路１０９の出力はＹＣ分離回路１１０により輝度信号と色信号に分割され、色処理回路１１１の中間で生成される色差信号が、画像が撮影された時の光源の色温度情報を検出するための色温度検出回路１１３に入力される。色温度検出回路１１３は色差信号を積分しＣＰＵ（図示せず）が読取り演算することでＷＢ補正係数が算出される。この係数はＷＢ回路１０９に設定される。

【０００７】次に、スイッチ１０７がｂ側接点に接続されることにより、メモリ１０６より画像データが読み出される。この読出された画像データは、クランプ回路１０８を経てＷＢ回路１０９に送られ、上記設定されたＷＢ補正係数に従って色フィルタ毎に補正され、ホワイトバランスを行っている。

【０００８】

【発明が解決しようとする課題】従来の撮像装置は以上のように構成されているので、画像データをメモリ１０６に一旦収納し、その後、ＷＢ制御のために色温度検出回路１１３による積分結果からＷＢ補正係数を算出し、再びメモリから画像データを読出すことでＷＢ処理を行っていた。このため、撮像動作と色温度検出を同時に行うことが出来ないため、撮像動作とＡＷＢ処理が同時に行えなかった。これにより、撮影間隔（フィールドレート）が低下し、表示速度が遅くなったり、高速連写や動画の撮像時には対応が困難であった。さらに、メモリ動作のための消費電力が増加し携行時のバッテリー消費が著しいという課題があった。

【０００９】この発明は上記のような課題を解消するためになされたもので、静止画や高速連写、動画などの様々な撮像モードにおいても高精度、高速かつ用途に応じたオートホワイトバランス制御が可能であり、高品質な画像を得られ、さらに、低消費電力の撮像装置を得ることを目的とする。

【００１０】

【課題を解決するための手段】この発明に係る撮像装置は、平面上に配列された複数の画素を有し、光学系を介して撮像した画像データを画素単位で出力するカラー撮像素子と、このカラー撮像素子の出力を蓄える記憶手段と、この記憶手段の入力側に配置され被写体に関わる色情報を検波するホワイトバランス検波手段と、撮像画面より少なくとも１画面以前の画像データに基づいてホワイトバランス処理を行う第１ホワイトバランス処理手段と、撮像画面の画像データに基づいてホワイトバランス処理を行う第２ホワイトバランス処理手段と、上記第１ホワイトバランス処理手段と第２ホワイトバランス処理手段との出力を選択する選択手段とを備え、制御手段は上記各手段の動作条件を設定する。

【００１１】この発明に係る撮像装置は、第１ホワイトバランス処理手段と、第２ホワイトバランス処理手段のいずれかの処理結果を選択してオートホワイトバランス処理を行うものである。

【００１２】この発明に係る撮像装置における第１ホワイトバランス処理手段は、撮像動作の確認時と撮像動作が連続する高速撮像時や動画記録時に用いるものである。

【００１３】この発明に係る撮像装置における第２ホワイトバランス処理手段は、撮像記録時と静止画記録時に用いるものである。

【００１４】この発明に係る撮像装置における第２ホワイトバランス処理手段は、ストロボ使用時に用いるものである。

【００１５】この発明に係る撮像装置は、第１ホワイトバランス処理手段と、第２ホワイトバランス制御手段の演算精度を異ならせたものである。

【００１６】この発明に係る撮像装置におけるホワイトバランス検波手段は、検波域指定手段を有するものである。

【００１７】この発明に係る撮像装置における記憶手段は、ホワイトバランス補正係数を画像データとともに記憶するものである。

【００１８】この発明に係る撮像装置における記憶手段は、複数の画面を記録する容量を有し、前記各画面に対応するホワイトバランス補正係数を記憶するものである。

【００１９】

【発明の実施の形態】以下、発明の実施の一形態を説明する。

実施の形態１．図１は、この発明の実施の形態１による撮像装置の構成を示すブロック図である。図１において、１はＲＯＭやＲＡＭ等を備えたＣＰＵ等の制御手段、２は電源スイッチやシャッタースイッチ等撮像装置の動作を設定するオペレーションパネルである。４は撮像レンズ、５は赤（Ｒ）・緑（Ｇ）・青（Ｂ）の各色信号を画素単位で出力するＣＣＤ等の撮像素子、６は撮像素子５を駆動するドライバ、７は撮像素子５のアナログ処理を行うアナログ信号処理回路、８はＡ／Ｄ変換器、９はアナログ信号処理回路７やＡ／Ｄ変換器８の駆動タイミングの制御や画像データに同期した信号を発生させるタイミングジェネレータ（以下、ＴＧ）である。

【００２０】１０はＡ／Ｄ変換器８の出力信号に対してＷＢ処理を行う第１ＷＢ処理回路、１１は被写体の光源の変化等による色情報を検波するＷＢ検波手段であるＷＢ検波回路、１２は少なくとも１画面分を収納可能なＦＩＦＯや２ポートＲＡＭ等のメモリ、１３はメモリ１２の信号出力に対してＷＢ処理を行う第２ＷＢ処理回路、１４は第１ＷＢ処理回路１０と第２ＷＢ処理回路１３からの出力のいずれかを選択する選択手段としてのセレクタであり、このセレクタ１４は手動または撮影モードに応じた自動選択である。１５は補間処理や色変換、フィルター処理等を行う画像処理回路、１６はＤ／Ａ変換器や表示ディスプレイの駆動制御等やビデオメモリを搭載した表示処理回路、１７は液晶等を用いたディスプレイとしてのモニタ、１８は撮像した画像を記録媒体１９に収納するための記録処理回路、１９は磁気記録や光記録、半導体メモリ等の記録媒体である。

【００２１】次に動作について説明する。オペレーションパネル２上の電源スイッチを押下する。被写体からの光は撮影レンズ４を通過し撮像素子５上に結像される。この撮像素子５は、ドライバ６によって駆動され、被写体に応じた信号を出力する。ドライバ６にはＣＰＵ１の指令によりＴＧ９を通じて所定のタイミングが与えられる。撮像素子５の出力のアナログ画像データ信号は、アナログ信号処理回路７によってゲイン調整等の所定のアナログ信号処理が施された後、Ａ／Ｄ変換器８によって量子化される。

【0022】A/D変換器8の出力であるデジタル画像データは、第1WB処理回路10に入力される。第1WB処理回路10ではWB検波回路11からのWB検波値に基づいてCPU1によって色毎の補正係数が算出され、この補正係数に従ってWB処理を行う(このフィードバックループを構成するAWB動作の詳細は後述する)。

【0023】また、第1WB処理回路10の出力は同時にメモリ12に収納される。この収納される過程においても前記のWB検波動作と同様に、WB検波回路11によってWB検波値が得られている。このWB検波値に基づいてCPU1により色毎の補正係数が算出され、第2WB処理回路13によってメモリ12からの画像データ読出し時にWB処理がなされる。

【0024】ここで、AWB制御の処理、検波、算出から成るフィードバックループ制御と、第1WB処理及び第2WB処理について図2,3,4を用いて説明する。図2は第1WB処理回路10及び第2WB処理回路13の構成を示すブロック図である。図2において、21は乗算器であり、A/D変換器8の出力であるR色データとCPU1からのR色のWB補正係数を乗算する。22、及び23も乗算器であり、同様にそれぞれG色データとG補正係数、B色データとB補正係数を乗算する。これ等乗算器21,22,23の出力R'データ、G'データ、B'データがWB処理後の画像データである。各色毎に個別の補正係数を有し演算処理することでWB処理を行う。

【0025】なお、A/D変換器8の出力はR,G,B独立出力であるとしたが、各色のデータがシリアルで得られる撮像素子5やA/D変換器8では、それぞれの乗算器の入力側にシリアルーパラレル変換器を用いれば良い。また、3つの乗算器21～23を用いるとしたが、1つの乗算器を使って各色の補正係数をその入力順に順次切換える構成としても良い。加えて、第1WB処理回路10及び第2WB処理回路13は乗算器を用いるとしたが、これはA/D変換器8からの出力とその被写体の光量(色情報)変化が線形であるためであり、非線型の関係にあるときはそれに応じた演算器を用いれば良い。

【0026】図3はWB検波であるWB検波回路11の構成を示すブロック図である。図3において、24は積分器であり、第1WB処理回路10の乗算器21の出力であるR'データを積分する。同様に25,26は積分器であり、それぞれ第1WB処理回路10の乗算器22,23の出力であるG'データ、B'データを積分する。これらの各色毎の積分器24,25,26の出力がR色,G色,B色各々のWB処理の補正係数算出に用いられる検波値である。

【0027】次に図4に示すタイミングチャートを用いて動作を説明する。フレーム同期信号は"H"のとき撮像素子5の信号出力が有効であることを示す信号である。#1画面では、WB検波回路11により#1画面の色毎の検波値が検波される。このとき、第1WB処理回路10のWB補正係数は所定の初期値を設定しておく(好ましくは、A/D変換器8の出力データをそのまま検波するように各色の補正係数を1とする)。

【0028】#1の検波値はCPU1に転送され、CPU1ではこの検波値を基にWB補正係数を算出する。算出法は、各色の平均値を検波値より求め、Gを基準にした場合、R補正係数Kr、B補正係数Kbは

Kr= 平均(R検波値)/平均(G検波値)

Kb= 平均(B検波値)/平均(G検波値)

(G補正係数Kgはこのとき1)となる。このようにして算出されたWB補正係数は、CPU1から第1WB処理回路10及び第2WB処理回路13に設定される。

【0029】従って、第1WB処理回路10は、次の#2画面を#1画面の画像データから得られた#1補正係数を用いてWB処理を行う。次画面以降のWB処理も同様にn画面のWB処理にn−1画面の画像データから得られたWB補正係数を用いる。

【0030】他方、第2WB処理回路13の動作は、メモリ12の動作と相関し以下のようになる。#1画面ではフレーム同期信号が"H"のとき、画像データをメモリ12に対し書込み動作をなすように、メモリ書込み信号を"H"にするので、メモリ12には#1画面の画像データが書込まれる。

【0031】#1画面が終了すると、WB検波回路11によって各色の検波値が得られる。この検波値より#1画面のWB係数の算出動作は上記と同様である。#1補正係数が算出され、この補正計数が第2WB処理回路13に設定された後であれば、任意のタイミングでメモリ12から画像データを読出す(メモリ読出し信号が"H")。読出された画像データは#1画面のデータであり、WB補正係数も#1画面に基いたものである。従って、第2WB処理回路13は、この#1画面の画像データから得られた補正係数を用いてWB処理を行う。次画面以降のWB処理も同様にメモリ10の書込み/読出し制御を行いながら、n画面のWB処理にn画面の補正係数を用いる。

【0032】この後の動作を図1に戻り説明する。使用者によるオペレーションパネル2上の設定に従い、セレクタ14によってa側接点を選択すると、第2WB処理回路13によるデータが、また、b側接点を選択すると、第1WB処理回路10によるデータが選ばれて後段の画像処理回路15に送出される。画像処理回路15では、補間処理や色変換、フィルター処理等の所定の画像処理がなされる。その後、表示処理回路16によってモニタ17に表示させるため、色信号変換処理、タイミング変換処理、解像度変換処理等の所定の処理を行い、撮影画面をモニタ17上に表示する。或いは、オペレーションパネル2の設定により記録動作指令が発行される

と、記録処理回路１８で所定のデータ変換を行い記録媒体１９に記録される。以上のような一連の動作により撮影を行う。

【００３３】第１ＷＢ処理回路１０と第２ＷＢ処理回路１３によるＡＷＢ処理の効果例は以下のように区別される。まず、第１ＷＢ処理回路１０を用いる方式は、少なくとも１画面前の画像データによる処理である。ＮＴＳＣ準拠を例に挙げると、フレームレートが３０Ｈｚと視覚的には高速であり、また被写体（撮影シーン）のＡＣ的な１／３０秒程度の急峻かつ連続的な画面の変化は実際ほとんどないために実用上は問題がない。また、撮像素子５の動作レートがメモリ１２の書込みレートより早い場合に、即ち、高速連続撮影時に有効である。次に、第２ＷＢ処理回路１３を用いると、撮影画面の画像データによる処理が可能であるため、高精度なＡＷＢ制御効果を得られる。

【００３４】以上のように、この実施の形態１によれば、ＷＢ処理回路を２つ有するＡＷＢ制御の構成としたため、使用者がその意図に応じて最適なＡＷＢ処理法を選択できる効果がある。

【００３５】撮像素子５はＣＣＤのみならずＣＭＯＳセンサ等を用いても良い。また、イエロー、マゼンタ、シアン等の補色系の出力信号が得られるものを用いても良く、この場合は一旦ＲＧＢにデータ変換した後ＷＢ処理を施したり、色差信号からＷＢ補正係数を加減算することでＷＢ処理を行う。加えて、メモリ１２の読出しデータに、ＷＢ補正係数の算出をＣＰＵで行うとしたが、補正係数算出をその機能を満たす回路で構成してもよい。また、ＷＢ処理にＧ色を基準にした補正係数の算出例を挙げたが基準色はどの色でも構わない。

【００３６】なお、この発明はＡＷＢ機構に関する撮像装置であるが、自動露光機能や自動焦点機能を搭載した撮像装置についても適応可能である。さらに、ＡＷＢ動作の収束性は、各色の検波値に基づき意図的に徐々に（所定の時定数を有して）ＷＢ補正係数を変化させても良い。

【００３７】実施の形態２．始めに、用いる撮像素子５の動作について図５を用いて説明する。　多くの撮像素子５は、撮影画面の確認用に「ドラフトモード」「モニターモード」等と呼ばれるモニター１７の画素数に合わせた解像度のデータを出力する（以下、確認モードと称す）。この時の撮像素子５の出力例を図５に示す。１からｎまでは走査ラインの番号を表したものである。Ａ）の撮影モードでは、１からｎまでの走査ラインをすべて出力するのに対し、Ｂ）の確認モードでは、１，３，５．．ｎ－２，ｎというように出力する走査ライン数の数を減らして、フレームレートを上げている。このようにして、全画素の読出しを行わず出力走査ラインを間引いて出力することで、モニター１７の表示レートに応じた出力を行っている。このような撮像素子５の動作を用いる場合には以下の動作を行う。

【００３８】図６に示すタイミングチャートを用いて説明する。電源投入時のモードは確認モードであるとする。ＣＰＵ１は確認モードの動作をなすように、ＴＧ９に所定のコマンドや動作タイミング指令を与える。ＴＧ９は予め設定された走査ラインのみを出力するようにドライバ６に指示し撮像素子５を駆動する。撮像素子５からは間引かれた画像データがフレーム同期信号に同期して出力される。

【００３９】この確認モードの＃１画面から＃３画面のフレームレートはＮＴＳＣ準拠の場合３０Ｈｚである。この後、アナログ信号処理回路７から初期係数が設定された第１ＷＢ処理回路１０を経てＷＢ検波回路１１により検波値が得られる動作は実施の形態１と同様であり、＃ｎ画面終了時に＃ｎ画面の検波値が得られ、その検波値に基づいて第１ＷＢ処理回路１０により撮影画面（＃ｎ）のＷＢ処理を補正係数（＃ｎ－１画面）を用いてＡＷＢ処理を行う。

【００４０】このとき、セレクタ１４にはＣＰＵ１よりｂ側接点を選択しており、第１ＷＢ処理回路１０の出力を後段の画像処理回路１５に送出する。画像処理回路１５で補間処理や色変換フイルタ処理等の所定の処理がなられた後、表示処理回路１６を通しモニタ１７に確認モードの画面が表示される。使用者はこのモニタ１７の画面を見ながら好みの撮影画面を確認する。

【００４１】＃３画面が終了した時点（確認モードの任意のタイミング）で使用者がオペレーションパネル２上のシャッターを押下すると、ＣＰＵ１はＴＧ９に対し撮像素子５が全画素の読出しを行うように所定の設定を行うとともに、第１ＷＢ処理回路１０に各色のＷＢ補正係数に「１」を設定し、また、メモリ１２に画像データを書込むように書込み信号を出力する。このときの撮影では多くの場合、全画素の読出しに時間がかかり確認モードよりもフレームレートが遅くなる。

【００４２】フレーム同期信号に同期してメモリ書込み信号を出力し、ＷＢ処理しない画像データがメモリ１２に書込まれると同時に、ＷＢ検波回路により撮影画面のＷＢ検波値が検波されＣＰＵ１に送出される。ＣＰＵ１ではＷＢ補正係数を算出し、第２ＷＢ処理回路１３にその補正係数を設定する。

【００４３】この後、セレクタ１４をａ側接点に設定し、また、メモリ読出し信号を出力して画像データをメモリ１２から読出す。読出された画像データは第２ＷＢ処理回路１３によりＷＢ処理され、画像処理回路１５に送出される。その後、表示処理回路１６でモニター１７の解像度に合わせた解像度変換処理等が施されモニタ１７に映し出される。他方、記録処理回路１８で所定のデータ変換が行われ、記録媒体１９に画像データが保存される。その後、再び確認モードに移行し上記と同様な動作を繰り返して撮像動作を行う。

【0044】このように、確認モードは第1WB処理手段10によるAWB制御、撮影モードは第2WB処理手段13によるAWB制御としたため、その撮影モードに応じたAWB制御が可能な撮像装置を得ることができる。たとえば、第1WB処理手段10は、撮像動作の確認時や高速連写時、動画撮像時に用いる。第2WB処理手段13は、撮像記録時や静止画記録時に用いられる。

【0045】さらに、確認モード時にはメモリ12や第2WB処理回路13の動作を止めておくことができ、撮像モード時では画像データがメモリ12に収納されると、カメラヘッド3や第1WB処理回路10、WB検波回路11の動作が不要になり、動作クロックや電源の供給を止めることができるため、低消費電力の撮像装置が得られる効果がある。さらに、実施の形態中ではNTSC準拠の表示方式であったが、PAL方式等はもとより、より高速な表示レートにも対応することが可能である。

【0046】さらに、ストロボ（図示しない）を使った撮影時には、以下のような効果がある。ストロボ撮影時には、CPU1によってセレクタ14でa側接点を選択しておき、メモリ12と第2AWB処理回路13によるAWB制御を行うようにする。このようにすることで、例えば、連続撮影時の間のストロボ発光した画面では常に自画面でのWB補正係数を用いてAWB制御を行うことができるので、高画質な撮像画面を得ることが可能な撮像装置を得られる効果がある。

【0047】つまり、ストロボ撮影時には、第2WB処理回路を選択するように設定しておくことで、従来ではストロボ撮影時にはダミーのストロボ発光をさせてWB係数を算出した後、撮影のための本発光を行うが、この発明はダミーのストロボ発光はさせなくともよいものである。

【0048】以上のように、実施の形態2によれば、撮影モードにおいてメモリに画像データ書込み後、すぐメモリ読出しを行うとしたが、この読出し動作は任意のタイミングで行えばよく、メモリ書込み動作の後すぐに確認モードに移行し、例えば、被写体の所定の事象が起こらなくなった後等にメモリ読出しを行って記録媒体19に記録しても良い。

【0049】また、上記実施の形態1及び実施の形態2では第1WB処理回路10及び第2WB処理回路13を同一な構成としたが、これらの演算精度を異ならせても良い。例えば、A／D変換器8の量子化精度が8bitであるとする。このとき、CPU1から算出されたWB補正係数は8ビットである。第1WB処理10の乗算器の構成を8bit×4bitとし、後者の4bitがWB補正係数である。第2WB処理回路13の乗算器構成は8bit×8bitとし、後者の8bitがWB補正係数である。この補正係数のビット数の違いは、小数点の位置が違うものである。図7に上記のWB補正係数の構成図を示す。第1WB処理回路10の補正係数は小数点位置（．）がLSBから2ビットと3ビットの間にあり、一方、第2WB処理回路13の小数点位置は、LSBから5ビットと6ビットの間にある。

【0050】従って、各WB処理回路でのWB補正範囲は2進法→10進法の計算をすると以下のようになる。
第1WB処理回路　‥　0～3.75
第2WB処理回路　‥　0～3.96875
CPU1ではWB検波回路11の検波結果から、少なくとも8ビットのWB補正係数を算出し、第1WB処理回路10には8ビットの補正係数から、下位4ビットを切り捨て、4ビットの補正係数として第1WB処理回路10に設定する。第2WB処理回路には8ビットの補正係数を設定しWB処理を行う。ここで、両者の違いは、第2WB処理回路13を用いると、より高精度のWB処理を行える。他方、第1WB処理回路10は演算器の構成が簡易であり、より高速なWB処理を行える。

【0051】このように、WB処理手段の演算精度を異ならせたため、用途に応じたWB精度を選択できることが可能となり、また、回路規模を小さくできるとともに、低コストの撮像装置が得られるという効果がある。

【0052】上記のビット数、及び小数点等の位置は任意であり、WB処理に十分な精度が得られば何ビットでも構わない。また、第1WB処理回路10の方が演算精度が高くてもよい。さらに、小数回路を用いない整数回路だけの演算などにも適応できることは言うまでもない。

【0053】実施の形態3．また、WB検波回路を図8のような構成にしてもよい。30はWB検波回路であり、31はカウンタとコンパレータ等から構成される検波域を指定する検波域指定回路、32は動作イネーブル入力を有するR積分器であり、第1WB処理回路10の乗算器21の出力であるR'データを積分し、R色のWB検波値を得る。同様に33，34はG積分器、B積分器であり、それぞれ乗算器22，23の出力であるG'データ、B'データを積分しG色、B色のWB検波値が得られる。

【0054】動作について説明する。撮影モードでは、出力走査ラインに同期したライン同期信号LGがTG9より出力される。このとき、CPU1より予め確認モードにおける間引き情報を比較値として検波域指定回路31に設定しておく。LG信号をカウンタでカウントし、このカウント値を前記比較値と比較する。比較値は動作イネーブル信号ENとなって積分器32，33，34へ出力される。従って、撮像素子5の確認モードにおける出力走査ラインのみを検波することになる。各積分器で得られた検波値はCPU1へデータバス線を通じて転送する。

【0055】確認モードでは、TG9に所定の設定をすることにより、間引かれた走査ラインが撮像素子5から

出力される。検波域指定回路３１は、常にこのＬＧ信号をＥＮ信号として出力する。従って、ＴＧ９からのＬＧ信号に同期して積分器３２，３３，３４が動作し、各色毎の検波値が得られる。

【００５６】このときの様子を図9に示す。図9において、Ａ）は撮影モード、Ｂ）は確認モード時における撮像素子５の出力と、検波対象走査ラインの関係を示した図である。Ａ）では、走査ラインが1から順に出力されているのに対し、矢示する検波対象ラインはＢ）の出力走査ラインと一致するように検波域指定回路３１を制御している。従って、撮影モードと確認モードでは、同一の走査ライン出力を用いてＡＷＢ制御を行うことが可能である。

【００５７】以上のように、実施の形態3によれば、検波域指定回路３１を設け、撮像モードが異なっても同一出力画素を検波してＡＷＢ制御を行うようにしたため、撮像モード間でのＡＷＢ制御を一致させることができ、違和感のない撮像画面が得られる効果がある。

【００５８】また、実施の形態3では、走査ラインの間引き方法は上記の限りではなく、間引き間隔は任意であり、また、走査第1ラインから第１０ラインまでのみを出力するといったブロック単位の出力方法でもよい。さらに、走査ライン（垂直方向）の間引きに対応するものであったが、図１０（Ａ）に示すライン中の画素（水平方向）を間引いて図１０（Ｂ）に示すように出力する方式にも適応可能である。

【００５９】実施の形態４．以下、この発明の実施の形態4を図１、図１１に従って説明する。図１１はこの実施の形態4におけるメモリ１２の内部を示す図である。メモリ１２は、アドレス空間０〜Ｎまでは撮影した画像データの有効画素を収納する領域である。４０はN＋1アドレスに収納されるＲ色のＷＢ補正係数、４１はN＋2アドレスのG色のＷＢ補正係数、４２はN＋3アドレスのＢ色のＷＢ補正係数である。

【００６０】ＷＢ検波回路１１からＣＰＵ1によって各色のＷＢ補正係数を算出する動作はこれまでの実施の形態と同一である。画像データがメモリ１２のN番目アドレスまで収納されると、ＣＰＵ1によって算出されたＷＢ補正係数は第２ＷＢ処理回路１３に設定されると同時に、ＣＰＵ1によってメモリ１２のN＋1アドレスにそのR色のＷＢ補正係数４０を書込む。同様にN＋2アドレスにはG色のＷＢ補正係数４１、N＋３アドレスにはＢ色のＷＢ補正係数４２を書きこむ。

【００６１】このようにすることで、メモリ１２には画像データに対応したＷＢ補正係数が存在する。次に、任意のタイミングでメモリ１２に収納されたデータを順次読出し、第２ＷＢ処理回路１３によるＷＢ処理、セレクタ１４を経て、画像処理回路１５による所定の画像処理が施される。メモリ１２のN番目アドレスのデータが読出されると、ＣＰＵ1は第2ＡＷＢ処理回路１３と画像処理処理１５に対し動作を中止する指令を出す。正確には、各処理回路の入力データと出力データが等しくなるように、例えば、データのバイパス動作指令を発行する。

【００６２】この後、ＣＰＵ1によりN＋1アドレスからN＋３アドレスに収納された各色のＷＢ補正係数４０〜４２を読出す。読出されたＷＢ補正係数も同様に第２ＷＢ処理回路１３及び画像処理回路１５に入力されるが、これらはバイパス動作に設定されているため、無処理のまま表示処理回路１６及び記録処理回路１８に入力される。表示処理回路１６では、画像データの表示処理が行われるが、前記のＷＢ補正係数は有効画素の範囲外であるのでモニタ１７には表示されない。記録処理回路１８では、画像データとともに前記ＷＢ補正係数を記録媒体１９に書込む。従って、被写体の画像データとそのＷＢ補正係数を同時に記録することができる。

【００６３】以上のように、実施の形態4によれば、メモリ１２上に被写体に応じたＷＢ補正係数を保存できるようにしたため、使用者がパーソナルコンピュータ等を用いて自在に画像の加工をする際に、その目安となるＷＢ係数を参照することが可能な使い勝手のよい撮像装置を得ることができる。

【００６４】また、実施の形態4では、記録媒体１９にＷＢ補正係数を記録する際、ＷＢ処理回路１３と画像処理回路１５を通過するとしたが、メモリ１２から記録処理回路１８までの専用データ線を設け、ＷＢ補正係数を書込む際にはこの専用データ線に切換えてから、ＷＢ補正係数を記録しても良い。また、ＷＢ補正係数を収納する位置は、任意であり上記の限りではない。

【００６５】実施の形態５．また、メモリ１２が複数画面の容量を有するときには、さらに効果的に用いることができる。このときのメモリを示す構成図を図１２に示す。図中の同一番号は図１１と同一相当である。N＋４アドレスからは２画面（＃２）の画像データが収納される。この＃２画像データの収納範囲はN＋ｍアドレスまでである。N＋ｍ＋１アドレスには＃２画面のR色のＷＢ補正係数４３、N＋ｍ＋２アドレスにはG色のＷＢ補正係数４４、N＋ｍ＋３アドレスにはB色のＷＢ補正係数４５が収納される。

【００６６】次に、動作について説明する。簡便のため２画面分の撮像動作について説明する。まず、＃１画面がNアドレスまで収納され、N＋１からN＋３アドレスまでに＃１画面のＷＢ処理係数が収納される動作は上記と同一である。＃１画面のＷＢ処理係数がメモリ１２収納された後、＃２画面をメモリ１２に収納する。このときの画像データはN＋４アドレスから順次収納される。N＋ｍアドレスまでに画像データが収納されると、ＣＰＵ1は＃２画面のＷＢ補正係数を算出し、N＋ｍ＋１アドレスにR色のＷＢ補正係数４３を書込む。同様に、N＋ｍ＋２アドレスにはG色のＷＢ補正係数４４、N＋ｍ

＋３アドレスにはＢ色のＷＢ補正係数４５を書込む。

【００６７】この後、ＣＰＵ１はＮアドレスを参照し、＃１画面のＲ色のＷＢ補正係数４０を第２ＷＢ処理回路１３に設定する。同様に、Ｎ＋１及びＮ＋２アドレスのそれぞれ、Ｇ色のＷＢ補正係数４１、Ｂ色のＷＢ補正係数４２を読出して第２ＷＢ処理回路１３に設定する。次に、メモリ１２の０アドレスから順次＃１画面を読出して、第２ＷＢ処理回路１３及び画像処理回路１５に転送しそれぞれの処理を行って、モニタ１７に表示若しくは記録媒体１９に記録する。また、ＷＢ補正係数をも記録媒体１９に記録する。上記の動作終了後、ＣＰＵ１はＮ＋ｍ＋１からＮ＋ｍ＋３アドレスを参照し、＃２画面のＷＢ補正係数４３～４５を第２ＷＢ処理回路１３に設定し、上記と同様に処理を繰り返して撮像動作を行う。

【００６８】以上のように、実施の形態５によれば、複数画面を収納できるメモリ１２に、画像データとそれに対応するＷＢ補正係数を収納できるようにしたため、撮影が連続する（連写）時にも、画像データとＷＢ処理係数の関係を保持するレジスタやフラッシュメモリ等を別に設けることが不要になり、低回路規模の撮像装置を得られる効果がある。また、使用者が撮影データとＷＢ補正係数の関係を把握する必要がなくなり、より使い勝手のよい撮像装置を得られる。

【００６９】

【発明の効果】以上のように、この発明によれば、カラー撮像素子の出力を蓄える記憶手段と、被写体に関わる色情報を検波するホワイトバランス検波手段と、撮像画面より少なくとも１画面以前の画像データに基づいてホワイトバランス処理を行う第１ホワイトバランス処理手段と、撮像画面の画像データに基づいてホワイトバランス処理を行う第２ホワイトバランス処理手段とを備えた構成としたので、静止画や高速連写、動画等の撮影モードにおいて、高精度、高速かつ用途に応じたオートホワイトバランス制御が可能で、高品質な画像が得られる等の効果が得られる。

【００７０】この発明によれば、第１ホワイトバランス処理手段と、第２ホワイトバランス処理手段のいずれかの処理結果を選択してオートホワイトバランス処理を行うように構成したので、使用者がその意図に応じて最適なオートホワイトバランス処理法を選択できるという効果が得られる。

【００７１】この発明によれば、第１ホワイトバランス処理手段は、撮像動作の確認時と撮像動作が連続する高速撮像時や動画記録時に用いるように構成したので、高速連続撮影時におけるホワイトバランス処理に有効である。

【００７２】この発明によれば、第２ホワイトバランス処理手段は、撮像記録時と静止画記録時に用いるように構成したので、撮影画面の画像データによる処理が可能であり、高精度なホワイトバランス処理効果が得られる。

【００７３】この発明によれば、第２ホワイトバランス処理手段は、ストロボ使用時に用いるように構成したので、高画質な撮影画面を得ることが可能な効果が得られる。

【００７４】この発明によれば、第１ホワイトバランス処理手段と、第２ホワイトバランス制御手段の演算精度を異ならせるように構成したので、用途に応じたホワイトバランス精度を選択することが可能となる。また、回路規模を小さくできるとともに、低コストを達成することができる効果がある。

【００７５】この発明によれば、ホワイトバランス検波手段は、検波域指定手段を有するように構成したので、撮影モード間でのホワイトバランス制御を一致させることができ、違和感のない撮像画面が得られる効果がある。

【００７６】この発明によれば、記憶手段は、ホワイトバランス補正係数を画像データとともに記憶するように構成したので、使用者はパーソナルコンピュータ等を用いて自在に画像の加工をする際に、その目安となるホワイトバランス係数を参照することが可能な使い勝手のよい撮像装置を得ることができる効果がある。

【００７７】この発明によれば、記憶手段は、複数の画面を記録する容量を有し、前記各画面に対応するホワイトバランス補正係数を記憶するように構成したので、撮影が連続する（連写）時にも、画像データとＷＢ処理係数の関係を保持するレジスタやフラッシュメモリ等を別に設けることが不要になり、低回路規模の撮像装置を得られる効果がある。また、使用者が撮影データとＷＢ補正係数の関係を把握する必要がなくなり、より使い勝手のよい撮像装置を得られる効果がある。

【図面の簡単な説明】

【図１】　この発明の実施の形態１による撮像装置を示す構成図である。

【図２】　この発明の実施の形態１によるＷＢ処理回路を示す構成図である。

【図３】　この発明の実施の形態１によるＷＢ検波回路を示す構成図である。

【図４】　この発明の実施の形態１によるタイミングチャート図である。

【図５】　この発明の実施の形態２による撮像素子の出力を示す図である。

【図６】　この発明の実施の形態２によるタイミングチャート図である。

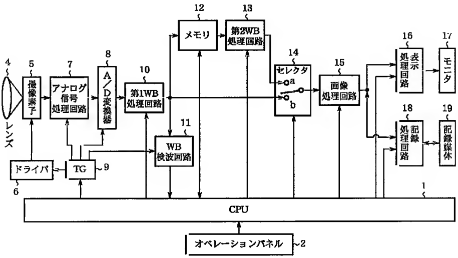
【図７】　この発明の実施の形態２によるＷＢ補正係数を示す図である。

【図８】　この発明の実施の形態３によるＷＢ検波回路を示す図である。

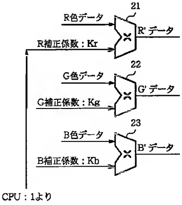
【図９】　この発明の実施の形態３によるＷＢ検波域を示す図である。

【図１０】　この発明の実施の形態３による走査ラインの間引き方法の説明図である。
【図１１】　この発明の実施の形態４によるメモリを示す図である。
【図１２】　この発明の実施の形態５によるメモリを示す図である。
【図１３】　従来の撮像装置を示す構成図である。
【符号の説明】
１　ＣＰＵ、２　オペレーションパネル、３　レンズ、５　撮像素子、８　Ａ／Ｄ変換器、１０　第１ＷＢ処理回路、１１　ＷＢ検波回路、１２　メモリ、１３　第２ＷＢ処理回路、１４　セレクタ、１５　画像処理回路、１７　モニタ、１８　記録処理回路、１９　記録媒体、２１，２２，２３　乗算器、２４，２５，２６　積分器、３０　ＷＢ検波回路、３１　検波域指定回路、３２，３３，３４　積分器、４０　Ｒ用ＷＢ補正係数、４１　Ｇ用ＷＢ補正係数、４２　Ｂ用ＷＢ補正係数、４３　Ｒ用ＷＢ補正係数、４４　Ｇ用ＷＢ補正係数、４５　Ｂ用ＷＢ補正係数。

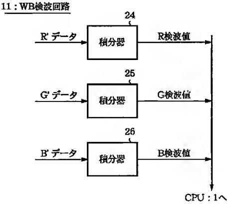
【図１】



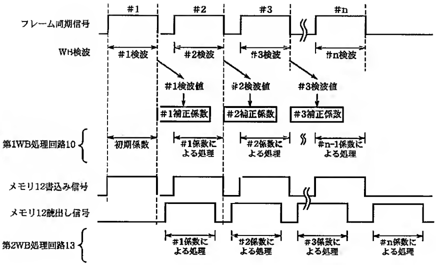
【図２】



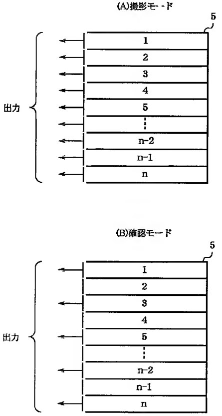
【図３】



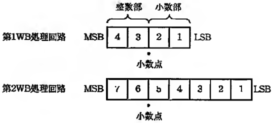
【図4】


#1
#2
#3
#n
フレーム同期信号
WB検波
#1検波
#2検波
#3検波
#n検波
#1検波値
#2検波値
#3検波値
#1補正係数
#2補正係数
#3補正係数
第1WB処理回路10
初期係数
#1係数による処理
#2係数による処理
#n-1係数による処理
メモリ12書込み信号
メモリ12読出し信号
第2WB処理回路13
#1係数による処理
#2係数による処理
#3係数による処理
#n係数による処理

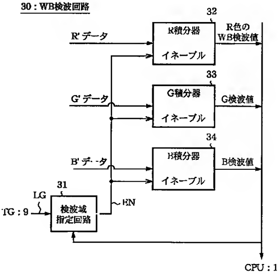
【図5】


(A)撮影モード
5
1
2
3
4
5
n-2
n-1
n
出力
(B)確認モード
5
1
2
3
4
5
n-2
n-1
n
出力

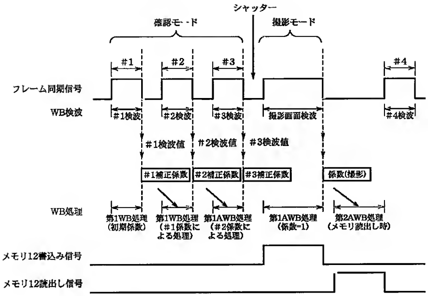
【図7】


整数部
小数部
第1WB処理回路
MSB
4
3
2
1
LSB
小数点
第2WB処理回路
MSB
7
6
5
4
3
2
1
LSB
小数点

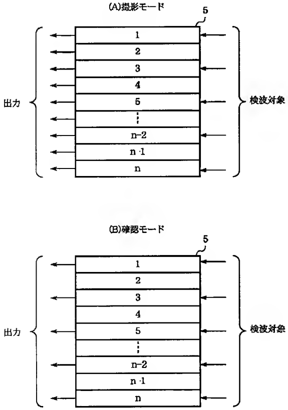
【図8】


30：WB検波回路
32
R'データ
R積分器
イネーブル
R色のWB検波値
33
G'データ
G積分器
イネーブル
G検波値
34
B'データ
B積分器
イネーブル
B検波値
31
LG
TG：9
検波域指定回路
EN
CPU：1

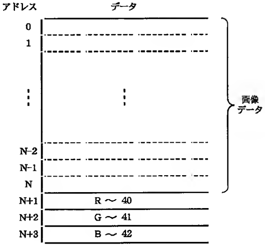
【図6】


シャッター
確認モード
撮影モード
#1
#2
#3
#4
フレーム同期信号
WB検波
#1検波
#2検波
#3検波
撮影画面検波
#4検波
#1検波値
#2検波値
#3検波値
#1補正係数
#2補正係数
#3補正係数
係数(撮影)
WB処理
第1WB処理（初期係数）
第1WB処理（#1係数による処理）
第1AWB処理（#2係数による処理）
第1AWB処理（係数=1）
第2AWB処理（メモリ読出し時）
メモリ12書込み信号
メモリ12読出し信号

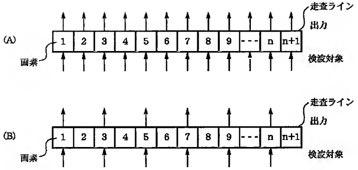
【図9】


(A)撮影モード
5
1
2
3
4
5
⋮
n-2
n-1
n
出力
検波対象
(B)確認モード
5
1
2
3
4
5
⋮
n-2
n-1
n
出力
検波対象

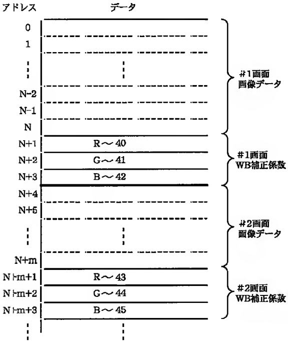
【図11】


アドレス
データ
0
1
⋮
N-2
N-1
N
N+1
N+2
N+3
R ～ 40
G ～ 41
B ～ 42
画像データ

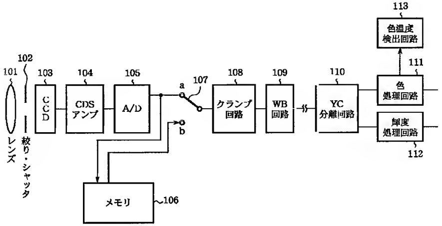
【図10】


走査ライン
出力
(A)
1 2 3 4 5 6 7 8 9 --- n n+1
画素
検波対象
走査ライン
出力
(B)
1 2 3 4 5 6 7 8 9 --- n n+1
画素
検波対象

【図12】


アドレス
データ
0
1
N-2
N-1
N
N+1
R～40
N+2
G～41
N+3
B～42
N+4
N+5
N+m
N+m+1
R～43
N+m+2
G～44
N+m+3
B～45
#1画面
画像データ
#1画面
WB補正係数
#2画面
画像データ
#2画面
WB補正係数

【図13】


113
色温度
検出回路
111
102
101
103
104
105
a
107
108
109
110
CCD
CDS
アンプ
A/D
クランプ
回路
WB
回路
YC
分離回路
色
処理回路
輝度
処理回路
b
112
レンズ
絞り・シャッタ
メモリ
106

フロントページの続き

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DD02 GG18 GG23 GG24 GG30
5C066 AA01 CA08 DD07 EA14 EC01
GA01 HA03 KD06 KE03 KE09
KE11 KE17 KE19 KM02